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OUR ISLAND-CONTINENT

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OUR ISLAND-CONTINENT:

A NATURALIST'S HOLIDAY IN AUSTRALIA.

BY

DR. J. E. TAYLOR, F.L.S., F.G.S.

ETC. ETC.

WITH MAP.

PUBLISHED UNDER THE DIRECTION OF
THE COMMITTEE OF GENERAL LITERATURE AND EDUCATION,
APPOINTED BY THE SOCIETY FOR PROMOTING
CHRISTIAN KNOWLEDGE.

LONDON:
SOCIETY FOR PROMOTING CHRISTIAN KNOWLEDGE,
NORTHUMBERLAND AVENUE, CHARING CROSS, W.C.;
43, QUEEN VICTORIA STREET, E.C.;
26, ST. GEORGE'S PLACE, HYDE PARK CORNER, S.W.;
BRIGHTON: 135, NORTH STREET.
NEW YORK: E. & J. B. YOUNG & CO.
1886.

1868

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OUR ISLAND-CONTINENT.

CHAPTER I.

OUTWARD BOUND.

A LONG-CONTINUED strain of literary work had rendered it necessary for me to take a long holiday, and get a complete change. Australia was the medically-appointed goal—perhaps because it was at the uttermost parts of the earth. The older generation in England has not yet got over the idea that to go to the Antipodes is like going into banishment. We have not realised the fact that it is only another part of Great Britain, and perhaps the most prosperous part. The terrors of the voyage have been, and are still, unduly magnified; for people have not learned that the first-class steamers are now only floating-hotels, and that there is more risk to life and limb in London streets than there is on board either the P. and O. or the Orient vessels. It is not exaggeration to say that there is more danger on board from the bar-room and card-room than from anything else.

It was a bright, dry, sunny day, early in April, when I left home on my long journey. The train

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carried me onwards past hedgerows budding with their first spring greenery; past hedge-banks masked with clustering primroses; past the brownish-green meadows, where sprouting willows mark the sinuous courses of streams; past familiar towns, churches, copses, mansions, and woods, and on to the great Babylon of London.

Away through the picturesque, undulating county of Kent, through the cold, flat clay lands of the Weald of Kent, where the labourers were planting the hop-poles; through the more broken and diversified parts, where the Wealden Sands and the Lower Cretaceous rocks appear, clad with spring woods, and to where the billowy chalk Downs roll seawards from Folkestone to Dover.

The weather had suddenly changed before I arrived at the latter place. It had become wet and windy, and it soon changed to blustery. The worst old tub of the many bad ones which convey passengers across the Straits to Calais lay bumping and straining at its moorings by the pier, and we had to wait and take our chance of a run or a plunge down the gangway on to the deck, amid a struggle of porters laden with luggage. Beyond the pier the "white horses" were rearing and rolling, and one felt that the Channel passage would be a good introduction to the "Big Ferry" over to Australia.

A school of French lads from Canterbury, accompanied by about a dozen priests, came swarming on board, roaming everywhere, shrieking, chattering, and jabbering like an over-populated cage of young monkeys. They were lively with Gallic liveliness for about half-an-hour, by which time our old boat was rolling, pitching, and tossing like a barrel, when they were quiet with a great quietness, and "the subsequent proceedings interested them no more!"

The train for Paris lay waiting at Calais pier, and as soon as the passengers had got nicely settled down to the meal they were deluded into paying for first, the guard announced that the train was starting. The weather had brightened up again, and the white chalk cliffs on the French side appeared the very counterpart of those the fond eyes gazed upon to the last about Dover. The fresh whiteness of the scars showed that the process of weathering backwards is still going on, as it must have been going on since the German Ocean breached through what was not long ago (geologically speaking) a continuous and unbroken extension of chalk from France to England. The rapidly-changing character of the rocks seen in the railway cuttings between Calais and Boulogne—passing suddenly from chalk to limestone like that of Derbyshire (for the Carboniferous formation immediately underlies the Cretaceous strata thereabouts)—is represented on the surface by a corresponding change of scenery.

On to Paris, all the way from Boulogne, I did not see as many sheep and cattle as I should have beheld in going a dozen miles through an English agricultural district. The peasants were scratching the ground here and there, where the long strips ran up the hill-sides, but signs of agricultural industry and prosperity were absent as compared with what one sees when travelling by rail in England. The season was much behind that of England, and the weather also was colder. There was hardly a tree in leaf in Paris, and the boulevards looked very wintry.

I hardly stayed in the "gay city" more than an hour. At 7.15 p.m., I went on by the Rapide, a night train, rightly so called, for it does the whole distance to Marseilles (536 miles) in fifteen and a-half hours. The train was very full of passengers going to Lyons and Marseilles, besides English and Americans going to Cannes and Nice. Four Americans were in the same compartment as myself and my young friend F., who was my *compagnon de voyage* as far as Melbourne. We were soon in the thick of "State" politics, and there was a rush to the buffet at every stopping-place, one of them occasionally bringing away "a five-franc fowl." The Yankees began comparing the various rates of European railway travelling with those in the States, and one of them proceeded to speak of fast travelling generally. There was one State waggon, he said, which went so fast that it could take a man farther in a day than he could travel back again in six months! "Which was that?" inquired one of the greener youths. "Why, it's the waggon that carries the prisoners to the State gaol!" said he.

Away we rushed through the darkness. The hours slowly crept by. Presently we were slipping in and out of tunnels, and the engine-driver was whistling as only French drivers can make their locomotive engines whistle. Then we came to Dijon. A few hours more, and we steamed into Lyons station, where we regaled on hot coffee. The grey morning began to break, and to contend with the waning moon for possession of the sky, as we passed slowly over the magnificent river Rhone. I looked out eagerly for the old town and bridge, and just got a glimpse of both, whereat I was much delighted, for over the mantelpiece of my study at home I had a famous etching of Lyons in 1783, by Boisseau.

We had left the country bald and bleak the night before; now, as the morning broke, the valley of the Rhone, along which we travelled, appeared as if suddenly clothed with fresh spring greenery. The orchards were pink and white with abundant blossoms, and the white vapours curled upwards from the not-distant Rhone, and so floated among and mixed up with the flowering groves that it was difficult to distinguish one from the other.

Presently the sun broke forth in all its morning glory! The picturesque hills just beyond the river are terraced with vineyards and olive-yards, and they came forth in delightful light and shade. There had been a white frost during the night, and it was some time before the air was warmed—not before we arrived at the fine old city of Avignon, where the Pope's Palace, built more than five hundred years ago, even yet seems as large as all the rest of the town put together.

Thence through a flat plain, occupied chiefly by olive-yards, to Marseilles. On the right hand the snow-capped mountains of Southern Switzerland appeared very crisply and distinctly. Our Yankee friends were glad they had seen Switzerland, they said, for now they would not have to go.

What is that? A glimpse of the Mediterranean. It makes one's heart beat faster, does the first sight of that historic sea, whose very name is so mixed up with the early history of civilisation that we cannot dissever the two. On its shores Phœnician, Syrian, Greek, and Roman civilisations, religions, and histories were developed.

Marseilles is a wonderful city—a French Liverpool and Portsmouth rolled into one, with a dash of Paris thrown in. The modern town is full of splendid, unpicturesque, solid stone buildings. The streets are wide and flanked with rows of Oriental plane-trees, the roads and side-walks are dirty and holey beyond description. The old town is extremely picturesque, and extremely filthy; and the "bassins" or docks (crowded with shipping of all kinds) were a perfect cesspool, occupied with a thick, pea-soup coloured liquid, which stank, and suggested that it must be a splendid place for bacteria, where they could increase and multiply and deplenish the earth. No wonder that cholera takes up its European headquarters at Marseilles.

The place was swarming with French soldiers, dressed in the oddest fashion—from the Zouave who seemed all trousers'-waist, to others whose trousers seemed all legs and loose boots. The costumes seemed very skilfully devised to prevent running away! Fifty thousand soldiers were being sent to China; for, as the host of our hotel told us, it was necessary now that France should "smash up" those rascally Chinese.

I left Marseilles by the *Yarra*, one of the magnificent fleet of Australian steamers owned by the Messageries Maritimes. She was splendidly fitted up, and lighted with electricity, but her passenger-list was very thin.

A strange world is a ship going to the Antipodes. But it would be difficult to find a better representative of ethnological features than were gathered together on board the *Yarra*. It was mainly French, of course, but the sailors, stokers, and general crew included also Arabs, Negroes, Malays, Chinese coolies, Indian half-breeds, and others I could not trust myself to mention. One could hear half-a-dozen languages at once. This strange assemblage of humanity loved to assemble in the bows, surrounded by pens of cows, pigs, sheep, calves, pigeons, guinea-fowl, pea-fowl, barn-yard fowl, &c. The Malays and Arabs delighted in occupying their leisure time in oiling each others' heads, and in a general entomological research in that happy and abundant hunting-ground. There was a wit among the party, but I unfortunately could not understand him. The old cocks soon recovered their sea-legs, and crowed lustily, happily ignorant of the pot; and every morning the smith's hammer made music on the anvil, so that the combined sounds were rural rather than maritime.

Our first-class passengers included a French judge and his wife, who were going out to the little known island of Mahotte, near Madagascar. The former was distinguished by the spurs on his boots, of which he seemed very proud, but to us English it suggested a commission in the Horse Marines—for that is the only branch of our service whose officers, I suppose, would wear spurs on board ship. There were also two Mauritius sugar-planters and merchants and their families.

The second-class passengers were mainly French, intensely vivacious, and therefore capital company. There was also a French Opera Company, going to Mauritius; and I could hardly forbear drawing comparisons between the draggled and wretched appearance the women had when sea-sick, and the brilliancy with which they would blaze forth on the stage! But nearly all the women seemed to think that to powder their faces and necks was quite as good as washing them.

The weather was rough and nasty in the Gulf of Lyons, but it brightened with a June brightness before we reached the Italian coast, where the island and mainland seemed shadowy and transparent in the hazy loveliness of a Mediterranean atmosphere.

A few days later we arrived at Port Said in the early morning. There is little regard paid to late sleepers on board ship. If you can sleep in spite of the rattling of cable chains, the holystoning of the decks, the tramping of too numerous sailors, and the ear-splitting boatswain's whistle—there is nobody else to prevent you.

The colour of the water showed that the blue Mediterranean was altered. There was now quite a scene on deck—a seething mass of colour, a Babel of voices! It seemed as if a thousand quarrels were about to break out among the boatmen and shore-loafers, who came jostling and crowding to the ship.

But they are in the infant stage, and not only say a good deal more than they mean, but don't mean what they say at all. So no quarrels broke out—only words.

On the quay, where I liked to linger most, the scene was intensely attractive. Multitudes of tall, lithe, and dignified figures, all clad in black, moved off in the coal wherries to coal the ship. On the quay, in numerous picturesque groups, clustered together many African nationalities, but chiefly Arabs, who did nothing, but looked picturesque in their ragged, striped, loose, and variegated garments—some sleeping, some smoking, some chattering, but all of them looking quite dignified.

Egypt has evidently never recovered from the Plague of Flies! They were everywhere, with the world before them to select from, and they had evidently made up their minds to select the corners of people's—especially of children's—eyes. There they clustered in disgusting density. I felt sorry for the poor children, who were trying to continue their broken sleep, so that I stopped several times to brush them away, but I fear both children and flies regarded my good intentions with suspicion. Many people, children included, appeared to be suffering from ophthalmia, and I have no doubt whatever that the flies are the chief conveyers of this terrible and contagious disease.

We were in the "Canal" by noon. On the left-hand side the Desert stretched away to the distant horizon; on the right hand was Lake Manzaleh, in whose shallow waters Arabs were wading up and down, knee-deep. Immense flocks of flamingoes collected in places, and then wheeled themselves into dense columns as they flew to some other fishing-ground. On the horizon line of the Desert, the *mirage* produced the most realistic resemblage of sheets of water, in which islands seemed to be scattered; and the optical deception was still more completely carried out when one looked at it through a field-glass, for then the imaginary islands seemed to be reflected in the water, and the rapidly-heated, upward-flowing currents of air gave all the appearance of waves breaking on a shallow sea-shore.

Shortly after passing the first "gare," or canal station, we got our first peep at genuine Arab nomadic life. A cluster of date palm-trees near the "gare" greatly assisted the Oriental effect. Several camels lay kneeling on the sand, their picturesque Arab owners squatted close by, smoking. Their guns lay on the ground, and their women, with veiled faces, were grouped at a respectful distance.

Presently the Canal passes through a country thrown into sandy undulations on both sides. The margins of the Canal are fringed with the bulrush (*Arundo phragmites*), so commonly seen in similar situations by the sides of our sluggish English streams. Here, in Egypt, it acquires an additional interest, for it is the plant amidst whose thickets the terrified but loving mother hid her child Moses. Another abundant plant is a species of *Tamarix*.

One night when we were "tied up" to the side of the Canal, I went ashore, and brought a handful or two of sand. Under the microscope one could see how well rounded are the individual grains of sand which compose it. Each grain was rounded by attrition, for the wind rolls and moves them with never-ceasing action. Near the sky-line, the steep faces of the mountains of Middle Egypt rise in the glare of the morning like shadows. I could see the stratification of their bold escarpments most distinctly. These sand grains once formed part of those very mountains—the mountain escarpments show that wasting and weathering are still going on. The most solid rocks of the earth's crust have their times of stability and instability. They share in the eternal rhythm of movement, and ebb and flow like the waves of the sea.

Next morning we were moving at break of day, and passed through Lake Timseh. Ismailia lay on the right-hand side, about three miles off, its houses and palaces nearly hidden amid palm and other trees. Thence we passed through the Bitter Lakes, and shortly afterwards arrived at Suez.

We were steaming down the Red Sea by noon, with the high, much denuded table-land of Middle Egypt on the right-hand side, and the dazzling hills and mountains of the Sinaitic Peninsula on the other. At this part we saw numbers of vessels, and we had plenty of company. When night came it was quite cheerful to see so many ships' lights about, but as we got into the broader part of the Red Sea, vessels were less numerous.

As usual, Mount Sinai was pointed out. Everybody was on the look-out for it, and its imposing mass became plainly visible just as the sun was going down. I could not gaze upon that grey old granitic mountain, even from a distance, without mixed feelings of wonder and awe. What a large place in the life of the world is taken up by the history of the transactions on that grim old mount!

Five days of a run down the Red Sea is a trying thing to the strongest constitution. We pass into a condensed kind of summer all at once. The sea was smooth almost to oiliness, and the flying-fish rose in shoals of from a dozen to twenty, especially in the early morning; and they ricochetted from wave to wave almost exactly after the manner of the thin stones which boys cause to "skim" over the surface of the water. I watched them much and often. As a group rose quite near to the ship, I generally selected some particular individual for observation. Its dark back and silvery belly, and the gliding, swaying motion of its extended pectoral fins, caused it to greatly resemble the motion of a swallow when the latter is hawking for flies over some stream. I noticed that the shoals rose more frequently in the early morning than during the broiling heat of the day; for though Nature may have evolved a flying-fish, she has not yet succeeded in developing a frying-fish.

Our ship was haunted by a following wind, so that the atmosphere on board was practically still and almost stifling. Life was only tolerable very early in the morning, but it was well worth rising early if only to see the sun-glows. The still and oily appearance of the sea converted the latter into a mirror. The eastern sky was filled with a glowing and a growing copper-coloured light, in which the large stars disappeared. From copper it changed to a soft rich primrose, and then to a strong brassy glare. In a few minutes the edge of the sun's disc appeared above the watery horizon, and God had ushered in another day! It was a sight never to be forgotten, and almost emotional in its effects. I have seen the sun rise from the top of Snowdon; I have beheld the still more famous "Alpen-gluhe," with which the ascending orb of day steeps the snow mountains of the Alps in rainbow-coloured lights; but I have never yet seen anything like the sudden and strong transitions of a tropical sunrise at sea.

In steaming down the Red Sea, after leaving the narrow, land-locked Gulf of Suez, the first island seen is Djebel Teer. It is of purely volcanic origin, and there was not the slightest evidence of herb or tree, or of anything living upon its barren, burnt-up surface. Its steep precipices showed how much it has been wasted by denudation—chiefly, if not wholly, by the sun's heat causing the particles of rock exposed to its fierce power to expand, and thus to be detached and crumble away; and yet the volcano has evidently become extinct quite recently. Then we passed a number of fragments of volcanic islands —those of Zebayer, which British sailors have christened the "Twelve Apostles." Three of them are quite perfect volcanoes, with craters and lava streams, and the latter have flowed over and masked the older and differently-coloured volcanic rocks. The nature of the sea-bed hereabouts shows how the volcanic action of these lately-operating volcanoes has modified its physical character. All around there the sea is deep, from 1,500 to 2,000 feet, but near the islands it shallows to 150 feet.

Then came the narrow neck of the Red Sea—the Straits of Bab-el-Mandeb. We passed the large volcanic island of Perim about half-past six in the morning. The British flag was flying from the battery, near which the huts of the native soldiers clustered. All else was a coffee-coloured stony desert. Aden was reached a little after noon, and we landed, and had time to hire a vehicle and go up to see the celebrated water-tanks, about six miles away. Aden is a volcanic country, and situated in what is practically a rainless region of the globe. All the rocks are of volcanic origin, although there are no volcanoes. Trachytic lava, agglomerates, and ashes make up the mass of the rocks. They are penetrated by dykes and veins of volcanic material of more recent date. Altogether one can hardly conceive of a more completely burnt-up land. It is hilly, ragged, jagged, cindery—completely unlike any other scenery I ever beheld. But Aden had undergone a transformation, nevertheless. Its hills were greened over with a delicate greenery, for it had rained there in March last—the first time for five years. The greenery was due to the presence of half-grown umbelliferous plants. There were also yellow-flowered snapdragons, wild mignonette, and others I could not identify.

The way up to the tanks is wonderfully picturesque. We drove along in a light Indian buggy, behind our chattering, copper-coloured driver, past a constant stream of men, women, and children—Arabs, Indians, Parsees, Jews, Somalis, and others, clad in all manner of costumes (or rather want of them), with the blazing sun adding light and colour; we passed by strings of heavily-laden camels coming in from the country far beyond. Some were lying down, and their drivers were feeding them with green food. On reaching the Arab town, we descended and walked through the crowded, noisy, and malodorous bazaar. The change was like magic. Little more than a fortnight before I was gathering violets and anemones in a charming Suffolk wood; now I was surrounded by all the conditions and circumstances of the times of the "Arabian Nights."

The tanks are by no means the highly antiquated structures which people who are ignorant of archæology sometimes make out. They are at different levels, right up in a kind of *cul-de-sac* in the hills, where the water is stored by banking up the places where it tends to ooze forth out of the rocks. Although it rains so rarely, when it does it rains heavily; and, as the volcanic rocks are very porous, nearly every drop sinks into the ground, and collects and circulates there.

We got back to our vessel just as the sun was going down. On the shallow foreshore Arabs were saying their prayers, and the dark kneeling, swaying, and bowing figures stood out distinctly against the glowing eastern sky like silhouettes. What selfish and unselfish desires alike enter Heaven through that common Gate of Prayer all the world over !

CHAPTER II.

THE INDIAN OCEAN.

EARLY next morning we left Aden on our long voyage. About mid-day we left the beaten track of outward-bound vessels, and hugged the African shores. The day following we were so close to the Somali coast that it seemed as if one could throw a stone ashore. With a field-glass all the country stood out clearly—a great arid desert, grilled with solar heat, not a tree or shrub being visible. A long line of white coral sand lined the shore, on which the long breakers broke into whiter surf. Then loomed up in the distance the perpendicular cliffs of Guardafui—the last we were to see of the Dark Continent.

Two days afterwards we crossed the Line. "Hot" is an utterly useless word wherewith to describe the temperature. Eating, sleeping, reading, talking—everything but drinking—was out of the question. There was little or no life visible on the oily sea. A few bonitos chased each other, leap-frog fashion—a few flying-fish every now and then ricochetted from one long roller to another—that was all. Overhead was a sky hard as brass, out of which the equatorial sun glowed like a furnace.

This state of things continued for nearly a week, when, in the hazy afternoon, land appeared in sight.

As we approached it, we could see little beyond groves of cocoa-nut trees, covering a low-lying bank, evidently a coral island. Two hours later a series of shadowy, cloud-like islands appeared, and just an hour before the sun went down we passed close to one of them, Praslin Island. Mahé also appeared in sight. To the right and left other islands came into view. Evidently we had approached a small archipelago. Before we reached Mahé the sun had set, and the short equatorial twilight was over. But the glorious greenness of the tropical vegetation on Praslin Island had been lit up with the most wonderfully beautiful sunset tints.

We lay off Mahé all night, and were not allowed to land. This was at the time a great disappointment to me, for though these islands are very small, and the largest of them, Mahé, does not attain a greater height than about 2,000 feet above the sea, they are of wondrous interest to a modern naturalist and geologist. On Praslin Island grows the celebrated double cocoa-nut (*Loidicea Seychellarum*), which I afterwards saw growing in the Botanical Gardens at Mauritius. These islands are, in fact, the celebrated Seychelles. On one of them nests the tropic bird (*Phæthon*), and we saw numbers of these birds about.

So desirous was I of landing for a few hours on these lovely, almost equatorial islands, that I returned from Australia by the same route. Fortunately I was then able to land at Mahé, and enjoy a short drive and walk up towards the hills, clothed to their summits with rank tropical vegetation. Turtles come to breed on the Seychelles, and are caught. Near the town of Mahé there are large tanks where we could see the huge reptiles, retained till they were required by calling ships.

Lovely corals accumulate in heaps on the shore, where, in the shallow places, the queer little Jumping Fish (*Cheironectes*) were skipping and hopping about in great numbers. We returned on board with abundance of gay flowers, and clusters of green cocoa-nuts, which latter were cut from the trees for us.

This archipelago is a most interesting study to the geologist, for the Seychelles Islands are the worn-down fragments of an ancient land. They are formed of granite, and to a geologist this fact means that a vast amount of strata must have been worn away from over them, perhaps as much as fifty thousand feet! If we could put back again all that has been removed by atmospheric and marine wear and tear, we should have a very extensive prolongation of land all the way from Zanzibar. Madagascar still remains as a fragment of the former eastern prolongation of Africa. Not only have all the strata, which formerly covered up and buried beneath them the granite of the Seychelles Islands, been altogether removed, but the granite itself has suffered sorely. You see it forming "cheese rings" and perched blocks—always a sign that weathering has been going on for a long time. In fact, the Seychelles Islands have not been submerged beneath the sea for ages, except local parts of them. On the contrary, as I said before, they are the fragments of a slowly-wasted extensive land, and it must have taken ages to have removed the vast thickness of strata which once covered them up and connected them all together !

The nature of the adjacent sea-bed throws some light upon their origin. The islands extend over an area of about four geographical degrees. To the north of this area the depth of the sea is nearly 8,000 feet, to the south it is more than 7,000 feet. On the submerged marine plateau over which the islands extend (big and little about fifty in number) the depth is comparatively small, being as little as 100 feet, and extending to 250 feet. An elevation, therefore, to the latter extent would make a splendid island of these fragmentary relics.

I should like to explore the natural botany of this ancient part of the earth's dry-land surface. There must be many old-world plants there, if cultivation has not rendered them extinct. One we know—the double cocoa-nut tree (*Loidicea Seychellarum*), already alluded to. It is found nowhere else in the world. The marine shell-fish, also, and other marine animals should be of the highest interest to naturalists generally.

Some parts of the chief island, Mahé, rise to a height of between 1,500 and 2,000 feet, but all are alike formed of granite. The late General Gordon, of Khartoum fame, had a leaning for a certain kind of Biblical research; and I believe that when he was commander of the forces at Mauritius he wrote an essay expressing his belief that the Seychelles Islands were the site of the ancient Paradise—the veritable Garden of Eden.

Our ship weighed anchor in the early morning, and I was up before the sun. The night before had been quite clear, and the moon was young. Her soft light tipped the rippling waters with broken lines of silver, and the strange land half a mile away looked like the recollection of a dream. In the grey of the early morning it came out clearly and coldly, wooded everywhere, to the tops of the highest hills. In the short twilight of the equator the lights change every few minutes, and the scene was dioramic. The Eastern sky grew in rich brightness, and the hill tops glowed in the morning light. Then the sun's broad disk peeped above the watery horizon; and the undulating land stood forth in distinct light and shade, its rich vegetation assuming all its characteristic tints. It was perhaps the loveliest scene eyes could behold. From the hill tops to the water's edge forests of cocoa-nut and other palm-trees grew in luxuriance. The island is furthermore rich in spices, in oranges, lemons, vanilla, coffee plantations, &c.

A series of small islands lie between the Seychelles and Madagascar (where similar ancient rocks occur), such as Providence and Farquhar Islands, and these were doubtless once part and parcel of the same extensive African continent I have above referred to.

Four days after leaving Mahé we arrived at Réunion—or, as it is perhaps better known to us in England, Bourbon—where we landed a number of French officers for Madagascar, for which place Bourbon serves largely as a military depôt.

Bourbon lies in about 22 degrees south latitude, and is between four and five hundred miles from Madagascar, but there is quite a deep sea between them, nowhere less than 8,000 feet deep. Consequently, it is not probable that Bourbon ever formed part of the ancient land of which the Seychelles are fragments. Hence, also, a geologist is not surprised to find there are no ancient rocks, such as granite, gneiss, slate, sandstone, &c., in Bourbon, and that the whole island is volcanic—built up on the bed of the sea of materials ejected from the interior of the earth, and not deposited as sediment. Indeed, the process of volcanic accretion is now going on, for there is a still active volcano (*Le Volcan*) at the south of the island, whose light can be seen at night; and one possibly extinct volcano (*Le Piton de Neige*) is 10,067 feet high, and, as its name implies, is nearly always covered with snow at the top.

A good many people from Mauritius and elsewhere visit the neighbourhood of Le Piton to drink the waters and enjoy the baths, and generally to recruit themselves from the jungle fever. As Bourbon is only one night's steaming from Mauritius, the former island is used as a sanatorium by the wealthy classes of the latter.

A pretty picture of the last surviving volcano in Bourbon (out of the crowd which have been geologically concerned in building up the islands both of Bourbon and Mauritius) will be seen in Cassell's "Little Folks' Annual" for 1885 (page 184). Amongst the curious features connected with this extraordinary volcano was an eruption which took place several years ago, when, during many hours, the crater shot forth showers of *talc* needles ("*Aiguilles*" *spicula*) an inch or two in length and inconceivably fine and sharp. These fell in such enormous quantities and over such a large area that for weeks the inhabitants of La Réunion, or Bourbon, did not dare to touch fruit, vegetables, flowers, or leaves—such spinous horrors lurked in all the softer forms of vegetation ! Miles out at sea the decks of passing vessels were covered, and their sails pierced with millions of the needles.

These high mountains naturally cause great rainfall, and the volcanic rocks rapidly decompose under its action. A very fine soil is thus produced, for there are no richer soils than those which result from the decomposition of volcanic rocks. Within the tropics this means an exuberant vegetation, and the carbonic acid resulting from the latter must still further assist in the process of sub-aërial denudation. Consequently, the island is covered almost to the summits of its highest mountains with a rich vegetation.

The day was just breaking when we anchored in the harbour of St. Denis—the principal port of Bourbon—and the scene was almost supernaturally beautiful. We had twelve hours to spend here, and we went ashore to spend them. The facilities for landing are very bad, and to nervous people must be very trying. Noisy blacks and half-breeds thronged round the ship, catering for hire, and in one of their boats we went ashore. The great rollers of the Indian Ocean break on the rocky, bouldery shores with immense power, and the small boats have to ride on these with much skill and dexterity. I was told that few accidents occur, but every moment it appeared as if one would happen; and it was not consoling toknow that the sea abounded with sharks, which latter must of course be always looking out for a meal. In rough weather landing is impossible.

St. Denis is a picturesque tropical town, full of fine, large houses, solidly built, and surrounded with extensive gardens. Out of these rise cocoa-nut trees, bananas, jack-fruit trees, screw palms, &c., and the houses and walls gush all over with tropical creeping plants and twiners, which break into the most bright and vivid colours, and fill the atmosphere with such a rich perfume that it even overwhelms the smell of the sewage, which flows down the large open "fleets," or gutters, of the streets. Even the palm-trees are draped and festooned with brilliant climbing plants.

I took a drive out into the country, away from the town. To an English naturalist visiting the tropics for the first time, this was like taking a trip into fairyland. My whole senses were steeped in preternatural delight; I felt as if in a dream. Here, by the roadside, were luxuriantly flourishing trees and shrubs, such as we see feebly growing in the fine gardens at Kew—palms of several kinds, bananas, with their long, broad, light-green leaves, groves of bamboos by the water-courses, bread-fruit trees, "jack" trees, mangoes, and a score of others from tropical lands beyond the seas, all thriving and contending for the mastery, as if they were natives of the island! The bushes and thickets were covered with coloured creepers, and scarlet, blue, and yellow flowers—the *weeds* of the country, but flowers which would grace any English hot-house—all abounded by the roadside. The latter was protected by hedges of prickly cactus, and cactuses climbed the trees, and hung down their weird branches like snakes over the traveller's head. Butterflies of gigantic size—metallic blue, rich green and black, yellow, and brown—flitted about in abundance; the very kinds one sees only in museums here basking in a state of nature! Huge spiders, a couple of inches across, built correspondingly huge webs in which to catch correspondingly huge insects. Even the land snails have risen to the occasion, and have assumed gigantic proportions, as witness the common and huge "Zebra" snail (*Achatina zebra*), abundant both in Bourbon and Mauritius. We have a solitary species of this tropical genus still living in England (*Achatina acicula*), about half the length and half the thickness of a grain of rice; whereas this common Bourbon snail attains to a span's length. Our British species may be a shrunken, poverty-stricken, and climatically-starved survivor from the Eocene period, when England also enjoyed a tropical climate.

Returning to St. Denis, I went to the Botanical Gardens and the Museum. The former is small, and of poor account, but the Museum is quite a model of its kind, owing to the devoted attention of its director, M. Lantz. He kindly took me round, and showed me the natural productions of the island—its rocks, minerals, butterflies, shells, birds, &c. There is also a fine collection of Madagascar birds, butterflies, and rocks.

We left Bourbon the same night. It was brilliantly moonlight, and the sea was almost as calm as a millpool. We had a host of passengers, male and female ; Creoles, half-breeds, Negroes, Hindoos, and Parsees, all bound for Mauritius. The latter place is only one night's sail, and we accordingly reached it next morning about six o'clock.

Mauritius is a beautiful island, but its principal town of Port Louis is not so picturesque as St. Denis. Like Bourbon it is wholly volcanic, and its period of volcanic activity must have extended over a long period of time, for we see volcanic rocks denuded into the most picturesque variety of outlines, from the most perfectly formed of craters. Everybody has heard of the celebrated Peter Botte mountain, whose outline was visible from the ship. It is not unlike the general shape of a champagne bottle, with the cork half drawn. Its form is due wholly to weather action, and in travelling through the mountainous parts of the island I saw "Peter Bottes" everywhere, large and small. This seems to be the characteristic shape into which certain of the Mauritian rocks naturally weather. Like those of Bourbon, the soils are very rich, and in some places they are many feet in thickness; varying from a brilliant chocolate to a coffee-colour, all abounding in iron—some of them quite heavy from its abundance. Moreover, there are very deep gullies and wide ravines worn out of the volcanic rocks by the action of running water; and "miles" of caverns and underground passages, worn out of the solid rocks by percolating water, are mysteriously said to exist in these volcanic rocks. Under all these circumstances we cannot wonder that Mauritius has been long enough in existence to have had at least one specialised form of bird, the Dodo (*Didus ineptus*), evolved upon its surface. This bird was a large, wingless pigeon, and was alive upon the island about two hundred years ago, at which time the island was completely covered with forest. Its remains have been found associated with those of gigantic land tortoises in some of the caves and swampy places. Its painted portrait, done by an unknown artist, who was little aware at the time of the service he was rendering to science, is in the museum at Oxford.

Port Louis impresses one at once by the more commercially flourishing aspect of the town over that presented by St. Denis. In the bay of the latter there were only two small vessels at anchor, at Port Louis there were sixty or seventy, although I was told this was a very small number comparatively. The chief product of Mauritius, like that of Bourbon, is sugar, manufactured from the cane, and fields of sugar-cane are seen all the way up to the tops of the hills. Cane sugar manufacture is just now under a cloud, owing to the system of bounty adopted by Germany and France to encourage the manufacture of beet sugar. But the sugar-cane contains 17 per cent. of saccharine, and, at present, only 8 per cent. of this is obtained: all the rest is wasted. So the most thoughtful of the planters are seeking to recoup themselves by a more complete and scientific method of extracting cane sugar, one which will utilise this vast amount of waste. If such an invention occurs—and surely it ought to be a scientifically easy thing to accomplish—the sugar trade will once more revive in Mauritius, and perhaps develop also by leaps and bounds in Queensland. A gain of six to eight per cent. in the present extraction of cane sugar, with the same outlay for labour, would be the best reply that science could give to the selfish unpolitical economy which can only keep decaying enterprise alive by a system of "bounties."

The town of Port Louis is a busy one; the wharfs and warehouses are numerous. There are abundant signs of great activity everywhere, in comparison with St. Denis. But it is not such a picturesque town, as most of the principal inhabitants live away up in the hills. The latter are delightfully green, except where their sides are too steep for vegetation to grow upon. There are over 600 miles of railway in the island, small as it is, and that to Cure Pipe is very remarkable. It gradually rises to a height of about 1,800 feet in a distance of fifteen miles, some of the gradients being as great as one in twenty-five. Our vessel remained in port thirty-six hours, so I went by railway to Cure Pipe, and stayed at an hotel there all night. The change from the tropical heat below was most delightful. The railway runs through mixed forests of banyan trees, whose aërial roots hang down like loose cords, and end by appearing like coils of vegetable snakes when once they have entered the ground. Besides them are groves of *Casuarina*—trees which reminded me of the appearances the ancient *Calamites* of the Coal Measures must have assumed. The characteristic Mauritian species is *Casuarina equisetifolia*, and this is the most geological-looking of the whole set, whose natural head-quarters, however, are in Australia. Palms, bananas, teak, &c., were all intermingled; fields of sugar-cane burst out in patches of brilliant green; stretches of aloes appeared, their tall flower-spikes forming prominent objects; banks of tropical plants and creepers broke forth (although the winter had commenced) in lush luxuriance, many of them being still in flower.

I returned from Cure Pipe early next morning, and proceeded to the Botanical Gardens at Pamphenmousse, about six miles from Port Louis. These Gardens have an extensive reputation, as being among the best in the world. They extend over seventy acres, and in the Tropics, where no glass-houses are required, the European visitor can hardly realise how palmsof all kinds, cinnamon-trees, teak-trees, bread-fruit trees, cactuses, mango-trees, &c., are growing in the open air. Everything is kept in the neatest order. We tasted the water tapped from the celebrated Traveller's Tree (*Ravenala*) of Madagascar, and saw the Lattice-leaf plant (*Ouivrandra*) from the same island, growing in ponds as a water-weed. Here, too, flourishes a specimen of the double cocoa-nut trees from the Seychelles, twenty-seven years old. But it will not bear its peculiar fruit for nearly fifty years to come; so the man who planted such a tree is like the Irishman who, on hearing that ravens lived one hundred years, bought one to try!

One of the most interesting natural history incidents which strikes the eye of the observer when promenading in the deliciously cool avenues of the gardens, is the long, brown trails running up the tree-trunks from the ground. They look as if the stem of some climbing plant had died and withered there. A close examination proves them to be the constructed tunnels of a species of ant. These tunnels are of great extent, and are composed of grains of earth cemented together so strongly that even the tropical moisture cannot decompose them. Within this earth-work the myriads of ants can safely pass up and down each tree, secure from the keen eyes of insectivorous birds. Almost every tree is marked by these covered ways.

The road from Pamphenmousse passes through numerous Hindoo villages, where the quiet people were at work—the open air barber's shop being evidently the chief collecting-place. The road was thronged with vehicles and carriers of every description, and was very dusty. Layers of dust lay on the hedges of prickly pears, on the climbing cactuses, and the otherwise glossy leaves of the banyan.

On arriving at Port Louis I went to the Museum, but I was much disappointed; for a museum ought to be the place where a person can see collected all that a locality is famous for. Mauritius is especially famous for its living corals, and I saw the sea lapping over the coral reefs at the mouth of the harbour, but there are hardly half a score of species in the Port Louis Museum. The collection of local rocks, insects, birds, &c., is almost equally deficient.

I took a carriage, and drove to Roches Bois, about seven miles away, through tropical woods and jungle, where the odorous flowers of the otherwise poisonous Frangipanni tree (*Plumieria*) was growing abundantly, and on to the finest of the coral reefs, and there I was satisfied to my heart's content. One old negro actually works and dredges the living coral-reef, in order to burn the living species of coral into lime, for there is no limestone on the island. I rescued half-a-dozen of the most lovely kinds, and such delicate loveliness I never hope to see again in the animal kingdom.

A Mauritian gentleman, Mr. Bewsher, is well-known to European naturalists as an ardent collector of the insects, shells, birds, &c., of the Mauritius and the neighbouring islands. Many new species which he has discovered have been named after him.

Near the Mauritius are seven more islets. One, called Round Island, about twelve miles away, is said to be composed of *sandstone.* I don't know to what geological formation it belongs, but the fact is very significant. It may be the fragment of some ancient land; for, although the island is only about one mile in diameter, it bears a species of palm not found elsewhere in the world, and it is full of snakes and lizards (some of the latter being very large), none of which are found in the Mauritius, but all of which are African forms. There is capital work for both naturalists and geologists in these Mauritian islands.

CHAPTER III.

FIRST GLIMPSES OF AUSTRALIA.

FROM Mauritius to Adelaide is fifteen days' steaming. The first eight or ten days are the most dreary part of the voyage, for we soon leave the frigate-birds and tropic-birds, which do not roam very far from the small islands and rocks which keep Mauritius company in the open Indian Ocean. The albatrosses take their places, and follow the ship for days, picking up the odds and ends which are thrown overboard from the *batterie de cuisine*, or devouring the jelly-fishes and other floating pelagic organisms which the ship's screw may have damaged. Every now and then we see these birds roaming right and left, until we lose sight of them; but they invariably return before long. Their wheeling, soaring, floating style of flight is wonderfully graceful and enduring; but I frequently saw them settling down for a rest on the water, and moving up and down with the billows in this state. There they would wait until a bigger wave than usual lifted them up, and from its crest they rose again into the air and continued their flight.

It is a dreary voyage this; not a ship visible for nearly a fortnight—alone on the open ocean. One day is the exact repetition of another. The sea is provokingly monotonous—one long roller succeeds another; all are of the same height and pattern. There is the same kind of sky—or rather a sky in whose vast expanse one sees every day the same meteorological phenomena. The flecking cirri-cumulus clouds form the main roof, and suspended thence are darker and larger nimbus clouds, some of which touch the water, and the dark, slanting lines show plainly where rain is falling. When this is not visible, fragmentary rainbows proclaim the same fact. The sunrises are frequently gorgeous, and full of rapidly-varying coloured effects; but they are soon over. The sunsets are more striking still, and the orb of day sinks below the watery horizon, followed, like a great monarch, by a magnificent cohort of crimson, orange, and yellow clouds. Then, in about a quarter of an hour, or from that to half an hour, all is over until the next day; and the dark, oily-looking rollers appear more melancholy and monotonous than ever, because of the contrast.

How a man's life narrows on board ship? He has not the anxiety of the captain and his officers on his mind; nor have his hands wherewithal to keep them employed, as the sailors' have. The passenger's chief thoughts are of the meals—dinner is the pivot on which the day turns. Human life on board ship is a miniature copy of the great world outside: it soon breaks up into knots and groups, attracted by likes or separated by dislikes. It has its little scandals and public opinion, which at the time appear justified, and afterwards are useful to laugh at, as showing to what trifles we can descend when we have nothing useful to do.

The storms at sea, which those who prepare for a long voyage dread most in anticipation, lose their terrors when they come. We almost hailed our first real storm, as something to break the monotony. Ships on our track always make for Cape Leeuwin, the extreme point of Western Australia, and, perhaps, the stormiest spot in the whole world. The ancient granite hills terminate in the Cape (on which a lighthouse now stands), and a few broken fragments or rocky islands plainly proclaim how much farther the Cape originally extended into the ocean. From this point vessels pass along the chord of an arc to Adelaide, the arc being the great indentation into the island-continent known as the Great Australian Bight.

It is rare, indeed, that the approach to Cape Leeuwin is otherwise than amid fogs, rains, and squalls. We suffered so much that our vessel, although of more than four thousand tons, was driven slowly backwards from her appointed track. The brave captain fought the storm, but for a whole day we were driven back at the rate of a mile an hour. Then, in the darkest time of night, and when the storm was at its height, the screw broke, or rather part of one of the segments of the screw-shaft. So we had to surrender our track, and put about, so as to get into some quiet spot for repairs.

A few days had to be lost, but this was of secondary importance. So we made for Western Australia, and put into Geographe Bay—a remarkable indentation in the coast line, and a magnificent harbour for ships which have suffered at the Leeuwin.

We sailed and steamed slowly, close to the land. Even with the naked eye one could see the caverns and huge blocks of stone at the base of the highly-coloured granite rocks. Here and there the gullies in the hills are occupied by blown sand, which the wind has evidently carried up them from the shore. After leaving Perim, and before making Aden, I had noticed how the bases of the dark-coloured volcanic rocks, and even the plains, were everywhere occupied by light sands, which seemed to take the place of water, and map the volcanic islets around with a sandy ocean.

The sand-seas in Arabia and Africa, however, are composed of particles detached from rocks by the expansive action of solar heat; whereas, the sand running up the hills of Western Australia looked more like the sand-glaciers (to which Professor Mosely has referred) in the Bahamas.

The outcrop of granite along the hilly parts of Western Australia plainly indicate how long the denuding processes of the atmosphere must have been going on before they could peel off and dissolve away the strata which once must have covered up the granite.

And here it behoves me to speak concerning the geological *antiquity* of what we may fairly call the Australian continent. It is well to do so, because I found, both at home and in Australia, that everybody thought Australia was a very *young* place—a sort of "odd lot," which had been thrown in at creation! Now, on the contrary, perhaps there is no part of the globe which can boast of longer periods of quietude and non-disturbance—I know of none where for so many ages there has been a longer period of terrestrial conditions. Europe has (in places, at least, if not altogether) been many times submerged, re-elevated, crumpled up in places into mountain-chains; and all the time the greater part of the Australian continent has been undisturbed; like Gideon's fleece, whilst all the rest of the world has been wet, it has remained dry. And so, through the later geological periods, Australia has been a kind of zoological and botanical "ark," in which the animals abundant in Europe and America during the Secondary epoch of geology, and the plants which were equally luxuriant there during the early Tertiary period (all of which, however, have been long extinct) have been preserved. This is the reason why the fauna and flora of Australia differ so essentially from those of other great regions of the earth's surface. No two planets of the solar system could present a greater botanical and zoological contrast than Australia and Europe do at the present time. And yet, in the *Eocene* period, the conditions were so reversed, that when Professor Unger had to write his celebrated essay on Tertiary fossil botany, he entitled it "New Holland in Europe"!

Now, this is the key and the secret to the right understanding of the Australian fauna and flora, and I emphasize it because I shall hereafter have to repeatedly call attention to facts bearing upon them. A naturalist, who is also a geologist, as he wanders in many parts of Australia, is living in the Secondary epoch, or in the Tertiary period. He there finds both zoological and botanical "restorations," which infinitely transcend in truth the modern "restorations," wherewith we endeavour to restore our decayed but still grand old Norman, Early English, and Perpendicular churches to their original estate and beauty.

For this reason I hope that my own personal observations and remarks about Australian animals, plants, and fossils, will have an interest for those who have long felt that our modern faunas and floras resemble the "New Moon which sleeps in the Old Moon's arms." That is to say, we can only truthfully understand the relationships and pedigrees of the latter by knowing when, and where, and how their ancestors and prototypes began their existences.

Thus I approached Australia with an indescribable longing and wonder. I felt like a young knight who had to keep tryst before his knighthood. I was on the threshold, not of the modern Australia, but of the far away Secondary and Tertiary periods of geological time. I was privileged, as it were, to be a geological Rip Van Winkle, and to see the animals living, and the plants and trees growing, whose ancestors ages ago had lived and grown in dear old England, and with whose fossil remains I was tolerably familiar.

And so my readers will perceive there is a glamour about Australia to a geologist and naturalist which no other part of the world can equal. It was a charmed land to me during every day and hour I was there.

The low-lying, but still strongly-featured, coast range of Western Australia is everywhere covered with timber, chiefly, if not entirely, with forests of jarrah-wood. Here I beheld the characteristic Australian gum-trees on their native soil. But the genus *Eucalyptus*, so largely and entirely represented at the antipodes, originally grew in Europe; and, perhaps, there first commenced its generic life. We find fossil Eucalyptuses in the Eocene deposits of the Isle of Sheppey, and also near Bournemouth.

The jarrah (*Eucalyptus rostrata*) is, perhaps, the most durable of all the species, and can be put to the same uses as mahogany. It is peculiar to Western Australia, where it grows in such immense forests that it promises to be a source of great revenue to the colony, and the jarrah-wood trade has already absorbed much capital, and will for years to come find abundant work for the labour market. The wood is said to resist the ravages both of ship-worms and white ants; so that it is sought after for the construction of piers, and for the sleepers of railways in tropical countries. It has also the virtues of teak in this respect, and is far more abundant and cheaper. A great trade in jarrah-wood is sure to spring up in the colony before very long.

The roads in this part of Australia can hardly be said to exist. I met with a remarkably jovial old colonist, a doctor, who had settled at Vass for about twenty years, and who told me he made his visits to far outlying patients in the bush by the aid of a compass, just as if he were at sea. The flora of this side of Australia is far richer than that on the Eastern or even Southern coasts. Unfortunately it was late in the autumn when I saw it during my flying visit, but I was told that, in the early summer, the sight of the flowers in the Western bush is one never to be forgotton. Singularly enough, the flora of Western Australia is widely distinct from that of the East, almost as much so as the floras of two geographically separated countries. This is because the East and the West were separated by a shallow sea during the greater part of the Tertiary period, so that the two floras thus assumed their individual characters without commingling. Wallace believes that the desert sandstones of the interior of Australia were formed then. New South Wales, Victoria, and Tasmania, were all joined together, so that the flora of Victoria and Tasmania is now practically the same.

Australia has undergone elevation everywhere along its coasts, except, perhaps, the north-eastern, where the extensive "Barrier-reef" exists. Hence, one author very aptly compares the whole country to a plate turned upside down. The flat rim represents the newly-added lands, due to upheaval from the sea-bed, and these are composed entirely of Miocene, Pliocene, and Pleistocene strata—all formed since the middle of the Tertiary epoch. The upper and higher parts of the upturned plate correspond to the elevated table-land, all of it formed of rocks belonging to various geological periods, from the oldest we know of, to the close of the Secondary period. So that, during middle Tertiary and later Tertiary times the country was less extensive than at present, although it was, perhaps, higher, for the hills and mountains have since then been sorely denuded. The land union between Victoria and Tasmania, therefore, may have existed during the time when our English white chalk and the London clay were being formed; and it was followed by a depression which went on until the physical change set in which elevated the shallow parts of the sea-bed, and tacked them on like a coast-fringe to the older rocks of the continent. Hence the origin of the rim of the upturned plate. It is over these newly-added lands that the corn-fields of Southern Australia extend; whilst in Victoria they are masked by sheets of lava, which more or less cover them up, but which, in their turn, have decomposed into the rich soils of the sheep pastures extending over the Victorian plains.

CHAPTER IV.

SOUTH AUSTRALIA: ADELAIDE.

JUST a week after the accident to our vessel, and I had sighted Western Australia, we anchored in Largs' Bay, about eight or nine miles from Adelaide. It was very early on Sunday morning, just when the day was breaking, when I came on deck to look at the country, little imagining my voyage would end there, for I had taken my ticket for Melbourne. The land before me was one extensive plain, dotted with clusters of houses and manufactories, all of which grew denser and thicker until they formed the city of Adelaide. Behind the latter, at the distance of four or five miles, rose the Mount Lofty chain of hills, which formed a magnificent background. Their highest points are about 2,300 feet above the sea. From the deck of the steamer these hills appeared singularly beautiful as they were tinged by the rays of the rising sun. They are much weather-worn, and rounded-off like our English chalk downs, and all of them are covered with "bush" and forest to their summits. Numerous gorges or "gullies" run up into them, and one could see at a glance there must be some very pretty rambles thereabouts.

I had hardly glanced at this scene before a letter was handed to me, the contents of which necessitated my landing at Adelaide instead of Melbourne. There was nothing for it but to pack up, and leave the good ship; but I am a bad hand at packing, and the job was a prolonged one. I got away in the afternoon, and arrived in Adelaide about three o'clock by a train from the pier—the train passing up the principal streets like a tram-car, violently ringing a bell as it went. It was the "Church train," and was filled with well-dressed people, all of whom had their hands full of hymn books, prayer books, and Bibles.

Thus I rattled into Adelaide—a city of churches. The latter are so boldly architectural that Wesleyan, Presbyterian, and Church of England are indistinguishable from one another. Their bell-music is not attractive; it is more like that of a number of school-bells authoritatively announcing the time. All the public-houses are closed all day on Sunday throughout the colonies, so that for quietness the Australian Sunday is more like a Scotch Sabbath than an English one. Moreover, these colonies have all of them a strong Scottish streak, which has affected the colonial speech, and is a prominent factor in the colonial dialect now being evolved, as certainly as the Yankees derived their nasal accent from the East Anglian drawl of their forefathers.

Wherever we examine the coast sections of this part of South Australia beneath the recently-formed sandhills, we see the strata which form the basis of the plains on which Adelaide and its pretty suburbs are built. The plains extend to the hills, and the river Torrens has cut its sinuous way from Mount Lofty through them, as the bluffs on both sides indicate. Beneath them we have nearly horizontal strata, which in some places attain a tolerable degree of hardness. Near the coast they are full of fossil shells, nearly allied to, and even identical with, genera and species still living in Australian seas. In fact, these rocks are of Pleistocene age—that which geologists indicate as the last of the well marked-off geological periods, and one, perhaps, most distinguished by the fact that it was then that man appeared on the face of the earth. Consequently, this part of South Australia must have been elevated since the close of the Pleistocene period. Other Pleistocene and Pliocene fossiliferous strata form a fringe of coast-land in South and South-eastern Australia, all of which clearly point out that this island-continent is undergoing a slow elevation.

In Adelaide extensive excavations have had to be made for the foundations of the new House of Parliament near the railway station. Here I obtained numbers of beautifully-preserved fossil-shells. Some of them occur as natural casts, the original lime of the shells having been dissolved away. Nearly opposite the site of the new Parliamentary buildings is Government House; and extending underneath the latter, and cropping out from beneath the garden-wall, the same strata are again seen to be full of fossil-shells, all of them indicating a comparatively recent or (Pleistocene) geological origin.

Not only is Adelaide a city of churches—it is a city of gardens as well. The main streets are wide, and the chief one (King William-street) would do credit to the finest city in Europe. The town gradually spreads itself into the country, being belted on every side by charming villas, each in its own little garden. The suburbs are separated from the city by the park lands—a magnificent belt of not-to-be-disturbed public gardens. The houses in the suburbs are generally only one storey high, and all are roofed with corrugated galvanised iron, which must make them very hot in summer. It certainly makes them look very new and ugly, but they are retrieved by the verandahs, and the abounding vegetation which drapes and festoons them.

Such a system of tramways as prevails in Adelaide I never saw before. The population of the city only numbers a little over 40,000, and yet I should think there are some hundreds of miles of tramways. They extend down all the main streets, and away to all the outlying townships six and seven miles off. You can get from one suburb to another by tram, just as you can in England by rail.

Another fact, which did not surprise me, is that the Colonials are a great newspaper-reading people. Here is a city, with not much more than two-thirds the population of what we should call in England only a moderately-sized town, which supports two morning and two evening papers, one fourpenny and one sixpenny weekly, a sixpenny illustrated *Punch*, besides a host of smaller journals.

Not only are the chief streets of Adelaide wide and capacious, but in a year or two more they will be greatly improved in attractiveness, for the boulevards will then be developed. On each side the causeway there have been planted rows of the handsome

Moreton Bay figs (*Ficus longifolia*). The trees have already grown to a height of 15 to 20 feet, and their large, glossy, evergreen leaves produce a dense and delightful shade.

It was the 18th of May when I arrived in Adelaide. This is equivalent to the 18th of November in England—a season when the ground is covered with rime frost, if not snow; when overcoats and mufflers are worn, and extra blankets are piled on the bed. But there the sunshine was quite hot, notwithstanding the low position of the sun in the sky—insomuch that one had to fear sunstroke if the back of the head was played upon by the sun's heat. People were still wearing pith helmets and puggarees. The air was delightfully bright and cheerful; it made one feel twenty years younger in spirits. Very little of the foliage had fallen, and all the gardens were full of brilliant flowers. In some of the larger gardens the floral brilliancy was increased by the masses of colour which the orange and lemon-trees presented. They were as full of golden fruit as productive apple-trees in England.

The English sparrows abound everywhere. They chatter and clamour and quarrel in the orange groves and palm-trees as they do in English hedges. To me their rows were delightful—they were so remindful of the dear old home over the sea.

The Queen's birthday was kept at Adelaide (as it was elsewhere) on the 25th of May (Monday). I was specially anxious to see how our Colonial brethren felt respecting their connection with the mother country. They are intensely and even demonstratively loyal. The day was a complete holiday. The Governor held a levée, to which no invitations are issued, but which is voluntarily attended by all who choose to don a swallow-tail and top hat. His Excellency shakes hands with each, and therefore is no doubt thankful when the day is over.

A grand review was held in the Park lands outside the Railway Station, and, as the day was brilliantly fine, the slopes of the ground were covered by well-dressed crowds of people. Just then the war fever was on, and Australians would rather have liked somebody to tread on the tails of their coats than not. So soldiering was popular—all the more so, perhaps, because the volunteers are *paid*. About two thousand were engaged at the Review. I was present at the march-past, and much admired the fine soldierly bearing of the men. They looked as if Australian mutton agreed with them, and also as if they had plenty of it. If ever a Russian or any other foe lands in Australia, these lads will make it hot for them!

I found Adelaide in a very depressed condition, and when I afterwards saw in the newspapers that three hundred emigrants were coming out to South Australia from England, I much pitied the emigrants. In Adelaide hundreds of men were out of employment, and standing at the street corners. Only a short time before, soup kitchens had been started to keep people from absolute starvation. The unemployed had held a mass meeting, and demanded public employment, and as each has a vote, and the united votes of such a body of men could turn an election, or make it hot for a Minister, they were offered employment on public works. It seemed to me that this policy of staving off an evil day by starting public works which are not wanted, but which will always require expenditure to keep up, is an unsound one from a political and economical point of view. A public loan is started to carry them out, and one State debt after another is thus contracted, so that the Ministry for the time being may have an easier time of it.

To return to the unemployed in Adelaide. Their wishes were assented to, and five-and-sixpence a day offered them. This raised a storm of indignation, and another mass meeting was held. "Who could live on five-and-sixpence a day, and bring up a family upon it?" they demanded. And I thought of many a poor and honest labourer, both in town and country, in England, who would be glad of half the chance. Let it be remembered, also, that meat is less than half the price it is in England.

"Depression" was the cry I heard everywhere in South Australia; and yet I cannot call it a poor country. It is in the condition of a man whose wealth is all locked up in plant, and who cannot realise. How can a country be called poor, which contains only as many inhabitants as Birmingham altogether, and which possesses 900,000 square miles—a country, too, rich in pastoral and arable lands, which raises large flocks of sheep, and is competing with the American markets in supplying us with corn—whose hillsides are covered with valuable forest trees, and whose hills are richly veined with copper and lead, besides containing even gold? Still, there was undoubtedly depression. Everybody felt it, or thought they felt it, and were depressed accordingly. The price of copper had fallen very low, and the earlier prosperity of the Colony depended on its rich copper mines. There had been three or four years of severe drought, when sheep died by scores of thousands for want of water. The low price of corn, also, had affected the South Australian farmers, just as it affects those in England.

But I found myself face to face with a new, and almost a comically new, view of a political situation. When I left England, farmers in East Anglia, almost to a man, were Protectionists, asking for a five-shilling duty on corn; whilst the working-men of English towns were Free Traders, because they got their loaves cheap. Here, in South Australia, the situation is exactly reversed. The working-men are Protectionists. They object to imported manufactured articles, even from the adjacent colonies, because thereby wages are kept up. On the other hand, the farmers—especially corn-growers—being short of labour, are Free Traders, for they want to get their ploughing and reaping machines as good and as cheap as they can.

There had been a great Russian "scare" when I arrived at Adelaide. The whole colony (as well as the other colonies) had armed. The young men (and the old ones, too) had rushed to their guns. The women had taken lessons in nursing. I believe lint was prepared by this devoted sex! Some of them had even drawn their money from the banks. How the Russians (or, for the matter of that, any other Power) will ever invade Australia seems not to have been thought of. The foreign men-of-war bent on such an errand would have to *coal* somewhere. Naval warfare is almost entirely a matter of *coal.* Where are foreign cruisers to obtain their supplies? There is only Diègo de Garcià—a little coral island half way between Western Australia and Aden—kept in stock for the supply of the Orient Navigation Company. The Russian cruisers could not obtain supplies for ten or twelve thousand miles.

There appeared to me to be a good deal of place-seeking in some parts, and men in office who have places at their disposal are terribly beset for them. There is a growing jealousy against outsiders, and a kind of "Australia for the Australians" policy is undoubtedly growing up and evidently developing.

I found footballing in great vogue. That and cricket are the chief games—although, so far, I cannot think the Colonists are fond of open-air pursuits, in spite of their fine climate. The football matches attract enormous crowds on fine Saturday afternoons; and the young fellows kick, and run, and wrestle well, for they have eaten three meat meals a day since infancy. Fine, strapping, lithe, *larrikin* young chaps they are, too! I attended a football match one afternoon, and there were at least five thousand people present.

My stay in Adelaide was, fortunately, during very beautiful weather. The clear sunshine and exhilarating atmosphere gave me some idea of what I had previously heard as to the delightfulness of the Australian climate.

South Australia had been panting and thirsting for rain for many weeks, and a few days before I landed the rain had at length descended. The hot and fertile earth had burst forth in grateful greenery, and the revived vegetation had broken out into a new spring. The gardens were full of vigorous, almost tropical, growth. What surprised and pleased me was to see how almost all kinds of trees and shrubs grow comfortably and prosperously together upon Australian soil. Some of the larger gardens are like botanical parliaments, where representatives from all parts of the world meet side by side—"pepper" trees (*Schinus molle*) from the Brazils, drooping their graceful leaves and clusters of pink berries, palms from Africa and India, cactuses and aloes from America, pines from California and Norfolk Island, and a floral crowd of herbaceous plants of cosmopolitan distribution. Not even in their native countries do these several species grow more rapidly or luxuriantly than in Australia. Formerly it was imagined that the best way to account for one kind of plant being found in one country, and a different plant in another, was that they were placed where the soil, climate, &c., were best fitted for them. But horticulture has upset that idea by growing all sorts of plants together on the same spot. Consequently we know that the geographical distribution of plants—the reason why one kind grows in America, and a second in South Africa, and a third in Australia—is connected with the repeated physical changes which the surface of our old planet has been undergoing ever since vegetable life began. Hence we see how plants of high antiquity may become extinct in one place, so that the only evidence we have that they ever lived and grew there at all is from their being found in the fossil state. This is the case with the now characteristic Australian order Proteaceæ, represented by the bottle-brush trees, Hakeas, Grevilleas, &c.—they are found fossilised in the older Tertiary or Eocene beds of England, but they are living and thriving still in Australian forests.

As a naturalist, I was, of course, acquainted with the well-known fact that the indigenous fauna and flora of Australia were unique, that nothing in the world approached them except those of Tasmania and (in part) of New Zealand—countries, however, which were formerly united by land union with some part or another of Australia proper. The fauna and flora—or, to use popular terms, the animals and plants of Australia—in some measure represent belated forms. Their original home and centre of origin appear to have been the north and not the south. Their family and generic types existed in Europe as far back as the Secondary epoch—many millions of years ago. Australia became a geological asylum for them when they were sorely pressed in the competition induced by the introduction of more highly specialised forms of life. Ages before the drift of Anglo-Saxon emigration, therefore, Nature had herself pursued the same lines, and had passed from the north to the south.

But whilst everything now living in Australia is so different from the old world—the plants, shrubs (and especially the trees), the insects, the birds, and more particularly the native mammalia—there is a wonderful resemblance between the rocks which build up the mass of Australia and those which compose the structure of any other ancient part of the globe. For whilst nature has adopted a thousand different means of evolving new types of animals and plants, she has been very conservative in her methods of rock-making. The process going on now has been going on in pretty much the same way through all the geological periods. Sediment, washed off the dry lands from weather-wasting, is carried by rivers into the sea, and laid down on the sea bottom. The sea animals, as they die, find a graveyard there, and so become imbedded as "fossils." The sediment hardens and becomes rock, is upheaved, and once more converted into dry land—is laterally compressed and metamorphosed, until it perhaps forms part of a mountain range or chain of hills. The fundamental rocks of all ancient land masses are strikingly alike. For instance, the Mount Lofty hills are composed of those rocks called by English geologists "Pre-Cambrian," because they are of more ancient date than those which build up the mountains of North Wales. In places the Australian rocks are much softer, however, and this has caused them to weather into round bossy outlines, whereas if they had been harder they would have assumed the same splintery appearance as the Welsh hills.

The Botanical Gardens at Adelaide naturally attract a wandering scientist. They are beautifully laid out, and in splendid condition; but the level nature of the ground does not enable the director to obtain the magnificent effect which the boldly undulating surface presents in the Melbourne Gardens. The Australian orders of trees and plants are well represented at Adelaide; but the labels were worn and often illegible. The Zoological Gardens are a model of their kind, considering the short time they have been in existence. The native animals—mammals, reptiles, and birds—are well represented, and all are in a healthy condition, thanks to the able director, Mr. Minchin, whose sympathetic nature constitutes him a fit and proper person to superintend a zoological collection. The Adelaide Gardens have also the advantage of being close to the city and in the Park lands, where everybody walks.

The Museum at Adelaide is a noble building, and it appears to be much frequented. There is an unusually fine collection of weapons from the South Sea Islands, and especially of native weapons and implements. In a very few years it will be utterly impossible to obtain genuine native implements, for few are now being made, and even they are of an inferior character as compared with the older weapons. I say "genuine" implements, because, although "globe-trotters" and "twelve-months'" tourists can buy war-clubs in the Sandwich and other islands, many of them are not made there, or, indeed, by natives at all. There is, I believe, a good trade done in Birmingham in manufacturing Fijian war-clubs, which are exported for tourists to buy.

The natural history and geological collections in the Adelaide Museum are much in need of scientific arrangement and classification. Objects which have not the slightest relationship to each other are grouped side by side, and the labelling of the specimens would also be improved by a more correct spelling of many of the names. This is a great pity, for there are some very beautiful and valuable objects collected together.

It is certain that the Australian colonies have been keenly alive to all the advantages of high education and advanced civilisation. Every little town has its "Botanical Garden." In Adelaide, besides the Museum, Zoological, and Botanical Gardens, there is the nucleus of a Public Art Gallery, with fine examples of leading English and European artists and sculptors, and a Free Public Library. There has also been founded a University, already taught by first-rate Professors, brought over from England, and each paid one thousand a year salary. Remember—this is in a town not so large or populous as Ipswich. And yet Adelaide was supposed to be in a very depressed state.

There was a great gathering of the natives, or rather of the Aborigines, in the Park-lands, Adelaide, whilst I was there. They slouched through the streets, they and their wives and children, and my heart went forth towards them, as I thought of their being thus treated as strangers in a strange land—and yet that land their own. Less than fifty years ago their fathers were in sole possession here—in this city of churches, chapels, museums, university, schools, botanical gardens, &c. What a change!

The aborigines of South Australia are nearly extinct, and they are gradually getting fewer in all the older colonies. Even the kindness of the whites is helping on their extinction, for the clothes and blankets given to them render them all the more liable to colds and consumption. Thus the good colonists help to abolish them, and the bad ones by treating them to drink. A corroborree was announced to take place in Adelaide during my stay there—the first which had occurred for twenty years. I need hardly say this is a native dance; and naturally, I did not wish to miss seeing such an interesting ethnological performance. But it so happened that everybody in the town was of the same mind; and as the weather was fine, and the night was moonlight, about 20,000 people were present. I had noticed that morning some of the aborigines settled in the city (the *civilized* ones) going to the corroborree rehearsal, with blue ribbons in their button-holes and short pipes in their mouths. They were members of the Salvation Army, and that night they were stripped as naked as the law would allow, and wore little clothing except white paint on their own black ground! The corroborree came off in an enclosure formed of hurdles. Within were lighted huge bonfires, and a couple of score of painted niggers trotted round the circle, and vulgarly mimicked the actions of native animals, whilst their wives, or *lubras*, kept up a monotonous chant. All on a sudden, the pressure outside caused the hurdles to give way, the crowd rushed in, and the aborigines, male and female, vanished in terror. It was a regular *fiasco*, which was not redeemed by the fact that a "Special Religious Service for the Aborigines" was held next day! Would it not have been better to have had the "service" without the corroborree?

CHAPTER V.

SOUTH AUSTRALIA: THE ENVIRONS OF ADELAIDE.

THE citizens of Adelaide inherit the fashion of going to the seaside in the summer time, ostensibly for sea-bathing and sea-air, just as we do in England. But our habit partakes very much of a farce at the Antipodes, where people cannot bathe unprotected for fear of the numerous sharks, and where the sea-air is like breathing the exhalations of a salt-oven. In Adelaide, Melbourne, and Sydney, the inherited instinct of "going to the seaside for a week or two" in summer, has still great play. But the better sense and wiser experience of the younger generation are correcting it; and we find that the hills and mountains are being selected for summer holidaying. Thus the lovely valleys and forest-clad slopes of the Mount Lofty range are besprinkled with the most charming villas. The Melbourne people go to Mount Macedon, Fernshaw, and elsewhere for the same purpose. At Sydney, the Blue Mountains and the hilly country about Mittagong are the fashionable and enjoyable holiday resorts. In the hills, people escape the fearful heat of the cities and plains, and find nature still green, and not burnt up. To all the Australian colonies, New Zealand stands in the part of another Switzerland—a *rôle* it can scenically afford to bear. Every year is making New Zealand more popular in this respect, and one sees young Colonials looking up knapsacks and preparing for ice-work in that lovely country, just as we see among the gilded youth of England at the end of June.

In perambulating the environs of the largest colonial cities and towns, the visitor is surprised to note how English they look, and how "well-to-do" English also. Of course, the wealth and the intelligence of such places gather in these neighbourhoods, and plenty of money soon enables the residents to transform the wilderness into a garden. And such gardens! The climate does for the residents what even the greatest wealth cannot do for us in Great Britain. Such lush, open-air growths of foliage and herbage—the petted costly vegetable darlings of our greenhouses and hothouses are cripples beside them.

But what a transformation such colonial city suburbs must have undergone. I was surprised to hear people in Adelaide recalling the time when these areas were "bush"—when the whole plain between Mount Lofty and the sea was covered with trees and shrubs, the forests consisting almost entirely of the "Peppermint" gum-tree (*Eucalyptus odorata*) and the lovely "Golden Wattle" (*Acacia pycnantha*). The river Torrens (now practically the city sewer) was then bordered by rows of red gum-trees (*Eucalyptus rostrata*). The following are the recollections of an ardent naturalist who had beheld Nature before she was disturbed by the settler and the colonist, in what are now the most popular and populous districts of South Australia:—

"In the open spaces there were immense clumps of *Bursaria spinosa*, covered with their sweet-smelling white clusters of flowers in summer, and afterwards with their curious purse-like seed-vessels. Towards and around Hilton, the plain was covered with polygonum bushes, and at intervals between the forests and the sea were belts and clumps of native pines (*Callitris robusta*), famous as a shelter for bronze-wing pigeons, whilst the bushy plains were literally crowded with quails, and the forests gave shelter to wild dogs, kangaroos, emus, &c., and the river was swarming with small fish of several sorts. There are very few of the trees now left standing."

All over Australia man has disturbed the botanical and zoological balance which had practically been undisturbed for ages. His interference has not always been for the best, although such was his intention. Thus, the introduction of the sparrow, rabbit, hare, hive bee, thistle, &c., has entailed endless cost and care, and it may be generations before the harm is removed. But Nature is assisting in the process. Just as a raw, red brick wall is kindly masked by her with the green drapery of moss, so does she soften down the asperities of man's botanical and zoological blunders, by calling upon the plastic vital forces to adapt themselves to their new environment, so as to eventually turn the curse into a blessing. Of this I shall have to speak more in detail later on.

At the end of the Australian summer the gardens and fields of the environs of Adelaide (and, indeed, for the matter of that, of Melbourne, Sydney, and other cities and towns also) are overrun by the Stink-weed (*Mula graveolens*), a composite plant, which has been introduced from the Cape of Good Hope, I believe. At that time of the year it is faded, and its pappous-crowned seeds are making arrangements for their extensive and widespread emigration. Towards the end of September (the beginning of the Australian spring), the same places were a perfect sheet of the most delightful primrose colour, for this plant was then in its early summer bloom.

The gardens and garden-keepers of the Australian cities and towns naturally despise this plant, notwithstanding its genuine beauty, simply because its selfish power of development renders the growth of anything else nearly impossible. Nevertheless, I heard when up country, from careful and competent observers, experiential remarks which indicate that this much-despised plant is actually exercising a great and beneficial agency in a country where the chief terror and destruction lie in the hot and dry winds. Formerly these winds blew in many parts of South Australia for three weeks at a time, both day and night continuously. Nothing could stand against them except the stinkwort. This plant, by covering the previously dry earth with its dark-green leaves, prevents the air from being unduly heated. Moreover, each full-grown plant exhales at least a pint of water per day, so that this beneficially affects the humidity of the atmosphere.

A railway from Adelaide now crosses the Mount Lofty range of hills, and it is a capital bit of engineering. It crosses the plains, and then commences the ascent in a series of varying gradients. Like other large Australian cities and towns, Adelaide has suburbs bearing familiar and cherished home names. One of these, Mitcham, arrested my attention when going by the railway. It recalled the pleasant little town in Surrey, famous for its lavender gardens and farms, and it caused me to wonder why flower-farming is not carried on to a greater extent in Australia. Here we find one of the most dependable of climates for the purpose—better suited for flower-farming than even the south of Europe. Even with our uncertain and wet English climate, where a good crop can only be expected every three or four years, lavender cultivation pays. Flower farming and the distillation and manufacture of essential oils and perfumes, will one day be another source of profit to Australia, I feel convinced.

When once we get into the deep cuttings on the Mount Lofty railway, we see at a glance how the rocks have been faulted, contorted, and upheaved. All of this took place ages ago. The surface contour of the hills has no relation whatever to the positions assumed by the strata, for the former is due entirely to weather action. These hills are the mere stumps, worn and abraded by the atmospheric wear and tear of millions of years, of what they once were. It would very much surprise us if we could put back again all the materials which have been stripped from the sides and summits of these hills, and carried away into unknown seas to be re-deposited along their floors. If we could replace the denuded rock, it is more than likely it would build up Mount Lofty into a peak as high as that of Mont Blanc!

On the summit of Mount Lofty, at a height of rather more than 2,300 ft. above the sea, Mr. C. L. Wragge (the distinguished English meteorologist of Ben Nevis fame, who recently came out to South Australia) has established an observatory. I do not think the practical value of comparative meteorology has yet been sufficiently appreciated in the colonies, but fortunately this does not affect ardent scientific workers.

I went up the mountain purposely to see Mr. Wragge's observatory. It was my first introduction to Australian bush scenery. The sight of various kinds of *Epacris impressa* for the first time—scarlet, crimson, pink, and white—was a great delight. There they all grew together, as high as my shoulders, and I had to thrust my way forcibly through them to pass on. Down in the gully the tree-ferns and grass-trees were growing, Banksias and Hakeas on the drier slopes. In places the Epacrids sheeted the hillsides with their magnificent blossoms. Parakeets and laughing jackasses resented our progress with characteristic cries and greetings.

It was interesting to note how, by the travelled roadsides, English wild plants are spreading themselves, such as the nettles, hawkweeds, shepherd's purse, groundsel, and the pretty Mary's thistle (*Silybum marianum*). The latter is, on the whole, rare in England, but it is spreading abundantly, both in South Australia, Victoria, and New South Wales; its green and white leaves being especially common near gardens and cultivated places. Pious Catholic tradition assigned the white patches on the leaves to the spilled milk of the Virgin during the flight to Egypt.

From the top of Mount Lofty a magnificent view spreads out. On the strip of plain below, Adelaide extends itself in picturesque disarrangement. Beyond is the sea, indicated by the vanishing lines of black smoke left by passing steamers. Behind us the dark blue hills of the Lofty Range succeed each other in billowy confusion—an old tableland, now represented by these hills, every-one of which has been slowly cut and carved into its present shape and size by the weather of successive geological periods.

Descending from the summit of the mountain by Waterfall Gully, we pass numbers of tree-ferns and grass-trees. The mountain stream increases in size and volume, and by-and-by throws itself over a precipitous ledge of rock into a basin below, where it is utilised for the Adelaide water supply. Beyond the point where the water is dammed up, just below the hotel, there is an extensive bank or bed of boulder-stones and pebbles, cut through in making the road. The boulders are of various kinds of rock, and the general appearance of the whole strongly resembles that of a glacial moraine. Professor Tait, of Adelaide University, has found undoubted rock striations in South Australia, and one can hardly imagine that rock glaciation would be limited, if ever a glacial period existed in the Southern hemisphere. The evidences of ancient glaciation are found, more or less, all over New Zealand, and the signs and tokens are beginning to turn up in Australia. If the bed of boulders, &c., to be seen near the Waterfall Hotel above-mentioned, occurred in England, hardly one geologist in a thousand would do other than assign to it a glacial or morainic origin.

I noticed similar accumulations elsewhere, near Gawler and Eudunda, for instance. At the latter place the upturned edges of the Silurian rocks looked as if they had been planed down, so sharp was the shearage. Unfortunately, these ancient rocks are on the whole softer than those of similar age in Europe and America, so that they sooner lose all the characteristic signs of glacial action.

There is a certain range of allowable variation entertained by geologists as to the exact age of the beds of marl, sand, shells, &c., which form the substructure of the plains extending from Mount Lofty to the sea. But to whatever portion of the Tertiary period they may be eventually assigned, after their formation they were upheaved, and then tacked on to the foot of the old mountain-range as a fringe of new land. Then commenced the existence of the Torrens River. It cut its way through the plains to the sea, and the steep sides of its bluff are like those of miniature cañons. One sees at a glance that the river has cut its own sinuous channel—nay, that it is continually engaged in widening and modifying it. Landslips are constantly taking place and falling into the bed of the stream, to be subsequently removed bit by bit.

An excellent improvement in the environment of Adelaide took place a few years ago, when the Torrens

River was dammed up, and a beautiful artificial lake took the place of an objectionable swamp and ditch. The Adelaide people are rightly very proud of their new lake. But it threatens to be a costly indulgence, for the river Torrens carries down an enormous quantity of mud and silt, and when the waters pass into and are checked by this lake, the sediments are thrown down. Consequently, the lake is rapidly silting up, and the difficulty is now to remove the silt. It seems a pity that the engineer did not make provision for a bottom current to flow out from the lower parts of the dam by a grating or movable valve, so as to carry the sediments away. Perhaps it is not too late now.

The later-formed deposits weather into excellent soils. Here and there they assume quite a travertine character, and occasionally harden into local patches. Nearer the sea they are occasionally salt. But there is plenty of fresh water finding its way to the sea-bed beneath them.

One notable South Australian vineyard, oliveyard, and orangery grows on these soils, that of Mr. Hardy, at Bankside. In company with a friend or two, I paid a visit to the place, which is only four or five miles from Adelaide. Mr. Hardy deservedly holds a high place among Australian wine-growers. He has been engaged in it at Bankside nearly thirty years—which means that he courageously commenced a new industry and a new speculation at a time when none but bold and brave men would have ventured on what seemed a perilous and risky speculation. That there is a great future for Australian wines, I am convinced. I tasted certain kinds during my stay in the colonies—dry, well matured, and old—which would compare not only favourably, but triumphantly, with even the best German hocks and the best French Sauternes. Many people at home complain of Australian wines because they have not "age" enough; but one might as well complain of a baby for the very same reason! The baby gets over the difficulty as he gets older, and the Australian wines will eventually be successful for the same reason. With the wonderful climate of Australia, with its volcanic and other weathered soils full of potash, iron, and other vine-food, with sound and educated vinestocks from Germany and France—stocks on which there has been bestowed more than a hundred generations of careful culture—it would be surprising, indeed, if Australia is not supplying the world with "wine that delighteth the heart of man" long after the worn-out vineyards of the old world have succumbed to horticultural starvation and entomological ravages.

In every respect Mr. Hardy's vineyards at Bankside are successful. I had scarcely cast looks upon the man before I knew that his vineyards and orangeries would be so. His face is that of an earnest and sympathetic man—one who would put his soul into his work, and who, if he had to cultivate plants of any kind, would identify himself with their interests and requirements. I was not wrong in my diagnosis. Each vine, orange-tree, lemon-tree, and olive was healthy. It looked as if it were cared for—as if it got all it required—and it responded accordingly. Douglas Jerrold spoke of new countries where you tickled the earth with a harrow, and it smiled with a harvest. So at Bankside. There was a strong growth, a sense of vegetable prosperity, such as can only proceed from a healthy and grateful and vigorous plant-life. Each vine-stock had room enough to grow in, and to get air and sunlight withal. There was no selfish overcrowding—after the manner with which people overstock the first aquaria they keep—and so there was little disease and death. Many agriculturists suffer from the same cause as overstocked aquaria—they sow too much, they plant too closely, they are in too great a hurry to produce. Vegetable overcrowding, whether in the corn-field, the garden, or the vineyard, produces the same effect as the overcrowding of human population in our cities and towns—it invites epidemics. The latter come as moulds, rusts, and mildews, which decimate the vegetable population and destroy the crops; and they whisper, as the moral of their visitation, that it would be much better and safer for man to be a little less greedy, and a little more patient.

Naturally, in coming to Australia, a stranger wants to see a "gold-field." The very name has a powerful influence. It suggests that nuggets may be found there and picked up, just as potatoes are in a "potato-field!" Of course, one soon gets disillusionised. But the comparatively vast quantities of gold which Australia has given to the world within the last thirty-five years surround an Australian gold-field with a powerful glamour.

There are gold-fields in South Australia, of course, and I found a certain desire (especially in official circles) to find more; although this was accompanied with a well-defined chariness in having anything to do with those already discovered. The Woodside gold-mines had been a good deal talked of, and the geological surveyors had reported well of them, and had given the usual statistics. A geological surveyor has not such an easy time of it in Australia as he has in England. The people there seem to think it his duty either to find a new coal-field or a new gold-field, and that if he cannot do either he does not understand his work!

Whilst at Gawler I drove over to the Barossa gold-field, about six or seven miles from the former place. Three or four miles of the distance passes over highly-cultivated and gently-undulating land, but the last two or three are simply primitive scrub. The abundance of bottle-brush trees (*Banksia marginata*) indicates a poor, hungry, sandy soil; but the waste ground thereabouts is a perfect garden for the botanist, so numerous are the varieties of plant-life. Several varieties of *Epacris impressa* abound, although the soil is chiefly occupied with the spreading growth of a singular proteaceous plant (*Isopogon*). The red-gum trees were much affected by the Australian mistletoe (*Loranthus*), which hung in pendent and luxurious bunches from two trees out of three—a vegetable thief which evidently finds blackmailing to pay! It was curious to see how its leaves mimicked the shape, size, and colour of those of its host-plant, as if it were anxious not to be discovered. Birds were abundant—robins, laughing jackasses, grass parrots, &c. It was not long before I heard a note which seemed familiar to me—a kind of harmonious *creak*, as if drawn upon the edges of a metallic small-tooth comb. Presently the objects came into view. They were two specimens of the red-billed Australian sparrows. They came within a few yards of me, and the sight sent a pleasurable pain through me. Ten years ago, in Ipswich, I had a pet Australian sparrow belonging to the same species. It was placed in the same cage as an old canary, and the latter amused itself by pulling out the red feathers from the sparrow's tail; so I separated them, and thenceforth my Australian sparrow had rest. Both birds lived in my study, and both were intimate friends of mine. When I came in, the Australian used to utter his "peek, peek," after the manner described, until I acknowledged the call. He lived with me three or four years, as one of my familiar friends, and then fell sick. I missed his cry very much indeed, and found that one of his legs was rotting—dying of *necrosis*, in short. I amputated it, and fitted him up with a wooden leg instead, on which he eventually learned to perch, but always very groggily. Then came another fit of sickness, and I found the other leg was going the same way. I cut it off, and replaced it by a lucifer match, *minus* the phosphorus end. Of course he could not perch, but he lived for three years on those two wooden legs, hopping on the bottom of the cage. Then he died, and I mourned for him as for a genuine friend. He is stuffed (all but his wooden legs), and is in my study at home to this day; and I never heard his familiar "peek, peek" again until one of his relations uttered it in the wild Australian scrub!

The Barossa gold-field is a deserted region, reminding us of the old diggings of Ballarat. There is a vast amount of quartzose sand, or "drift," the results of the weathering action of the surrounding and much-worn hills for, perhaps, hundreds of thousands of years. The thickness of this deposit is shown by the deep ravines and gullies—miniature cañons—which the streams have cut through it. This "alluvial" has not been half-worked, for there is no water to wash it. Perhaps when the people of Adelaide complete their supplementary water reservoir near Gawler (as they contemplate), hydraulic working may come in. I found two or three men still fossicking about, and they showed me samples of gold they had obtained in their rough-and-ready fashion, which plainly showed the gold was there. But I was more interested in the vast numbers of carnivorous plants, or sundews (*Drosera spathulata*), which in places covered the ground to the exclusion of everything else. Their leaves were all glittering with the viscid "dew" which traps the insects, and obtains for them their popular name; and many of the leaves contained dead insects of various kinds in every stage of digested decomposition. In places the surface was quite of a red tint from their abundance. I also took advantage of my short stay at the flourishing and picturesque town of Gawler, to visit the celebrated Ostrich Farm which has been started outside in the bush four or five miles away. Another ostrich farm, belonging to the same company, has been started near the coast; but it has not paid so well as that at Gawler. I now refer to this farm because I think it suggests a new and important, and likely to be successful, form of industry for all the Australian colonies. This particular farm at Gawler, I understand, pays remarkably well, and there is no reason why more of them should not exist in Australia. The farm includes about 170 acres. The intelligent manager of the farm, Mr. Rankine, was very ready to give me all the information required. There are about 100 adult ostriches, which are enclosed in 26 paddocks formed of wire fencing. The ground is left in its natural and uncleared state of bush. One male and one female bird are usually enclosed in each paddock, for although ostriches are not monogamic, yet if two females are placed in the same paddock with the male, the latter usually selects one as a favourite, to the neglect of the other. The eggs take about six weeks to hatch. Formerly the hatching was artificially performed by incubators, but it was subsequently found that the birds would sit and hatch the eggs themselves. In this task the male assists the female bird, so that the old, old story about the ostrich burying its eggs in the sand and leaving them for the sun to hatch is a zoological libel. All the birds were in a most healthy condition, as was evidenced by the bright colour of their legs and mandibles. They are fed twice a day on lucerne and cabbage, with an alternative diet of maize and turnips, and of course the birds get the necessary pebbles and stones for gizzard trituration for themselves out of the ground. I was much amused as I drove round the farm by the humorous old manager, a genuine Scotchman, addressing the long-legged, long-necked birds—which frequently came much too near to be pleasant—by antique Scottish patriotic names. One was "Roderick Dhu," others "Bruce" and "Wallace," &c. The breeding birds for this farm (which was only started four years ago) cost £100 each. In some of the paddocks were flocks of six and eight young ostriches—pretty little objects, with peculiar striped markings. They are altogether of a different colour to the parents, and in the Zoological Gardens I was very much struck with the striking resemblance the young of the emu bear to those of the ostrich—illustrating the zoological truth that the young of the species of the same or nearly allied genus approach each other much more nearly than do the adults. It is not until the young male is a year old that he begins to assume his characteristic black coat. When the young birds are only eight months old some of their feathers may be taken. As they get older the feathers are plucked every four months, and as many as weigh one pound and three-quarters are not unfrequently taken from a single bird. There is a feather storeroom at the farm, where we saw the tempting harvest. I was pleased to hear that the Gawler Ostrich Farm was such a success, inasmuch as it is only one out of numerous similar enterprises which the climate of Australia will enable its inhabitants profitably to undertake.

CHAPTER VI.

SOUTH AUSTRALIA: IN THE BUSH.

FROM Adelaide there are many excursions which can be made up into the country, as towards the Great Lakes, or even up in the Flinders Range. Very shortly the railway between Melbourne and Adelaide will be completed, and this will practically open out a new country to the tourist, for the present overland mode of travel does not allow of sufficient time for exploration.

Meantime, the wandering naturalist cannot do better than visit the valley of the Murray. There is now a railway from Adelaide to Morgan—a little town near the great north-west bend of the river. Everybody has heard of the Murray as being the principal river in Australia. Perhaps no other geographical feature gives one such a vivid idea of the vast extent and area of this island-continent. When we are told that one only of its rivers is more than 2,000 miles long, we obtain a mental grasp of the absolute bigness of the country. This river, together with its main tributaries, must have had a long and varied physical existence. Its upper reaches date backwards, perhaps, to the Devonian and Carboniferous periods; its lower lengths, the boldest and most strikingly-picturesque parts, are comparatively modern. In its upper reaches, there are places where the Murray has cut its way through cliffs 3,000 feet high. It drains half a million of square miles of country, and is one of the geologically-oldest rivers in the world. Thus the different parts of even the same river have not all of them necessarily the same geological age, nor are they due to the same physical causes. This may seem a new doctrine to those who have hitherto imagined that all the rivers of the world were formed at the same time and in the same manner.

I made Morgan my head-quarters for the short time at my disposal. It is rather more than 100 miles from Adelaide, and is the terminus of the railway from the latter place, which runs through Gawler, Kapunda, and Eudunda. Up to the former town the country is flat, and almost entirely devoted to corn-growing. Beyond it gradually becomes pastoral. The railway slowly ascends until a height of 1,700 feet above the sea is reached. The rocks are Silurian, and perhaps also of Devonian age. They show extreme signs of disturbance, insomuch that the bed of Devonian limestone at Kapunda is crystalline in its structure, and is worked and subsequently polished into marble. The upturned edges of the strata, as seen in the deep railway cuttings before we arrive at Eudunda, are often as cleanly cut on the surface as if they had been sheared with a knife or purposely planed down. I know of no natural physical agent which could have produced this effect, except that of moving ice.

The hilly country about Eudunda reminded me strongly of some parts of Westmoreland. Although it was very droughty when I arrived, and rain was much required, one could see at a glance that it was a splendid pastoral land.

Beyond Eudunda, the country grows tamer, and the mallee scrub sets in. A few miles further, the railway cuttings exhibited magnificent sections, showing a bed of limestone resting on the upturned edges of the primitive rocks above mentioned. As we proceed we find the limestone bed thickening, until at length it occupies the entire depth of the cuttings. Thence it extends uninterruptedly to the bluffs of the Murray, and far beyond on the other side.

The Murray River in these parts is belted by a zone of at least twelve miles of mallee scrub, which is nearly co-extensive with the limestone formation. The sight of the mallee was not to be forgotten. It recalled stories of being "lost in the bush," and I am afraid that the greater portion of the people in Great Britain imagine that Australia is all "bush," except in the neighbourhood of large towns. What struck me most was the uniformity in character of the vegetation. Mallee, saltbush, bluebush, and spinifex grass repeated themselves again and again. Here and there grew a she-oak or a native pine, and occasionally there was a green oasis which, from some unaccountable cause, the mallee had not invaded.

We reached Morgan near midnight, found our way to a most comfortable and clean hostelry, and were up betimes next morning. There was a sharp, clean, crisp feel in the air, which instinctively declared the place was a healthy one. The smell of the burning gum-wood from the fires of the scattered houses had an aromatic perfume. Morgan is close to the river, and all round are strewn masses of the limestone I have just mentioned. These were speedily overhauled and found to be full of fossils. Shells, corals, sea-urchins, fishes' teeth, were in great proportion. The wonderful way in which these fragments of a former Australian world were preserved elicited our admiration. Each block was a geological museum. Evidently the organic remains had lived and died where we now found them. These limestones were deposited during the Miocene period, when the sea came up into the interior of Australia as far as Wentworth. The living marine animals formed the limestone by their accumulated remains. Then came a period of upheaval, probably connected with the volcanic outbursts of lava all the way from Mount Gambier to beyond Melbourne. The former sea-bed thus became converted into dry land, and the lower part of the Murray cut its way through as fast, or rather as slowly, as the upheaval went on. Thus, this part of the Murray River cannot be older than the close of the Miocene period.

Part of the river bluff runs right up to the railway station, and then strikes to the right hand up the river. The river has cut its way clean through, and therefore in this part of its course it must be newer than the formation it intersects. The current eats away its right side, chiefly at the bottom, causing the upper part to be detached, so that the precipices of the bluff are not only perpendicular, but in most places overhanging. In several spots these precipices are more than a hundred feet high. The other bank of the river is silted up as fast as the right bank is eaten away, and thus an alluvial plain has been formed, in places more than a mile in diameter, with here and there lagoons connected with sinuous creeks, but in flood time the whole area is a watery waste. These alluvial flats are thickly covered with timber, and in places they have a very park-like appearance. This part of the Murray had been suffering dreadfully from the long-continued drought when I was there, and the river was unusually low—lower than it had been for years, the oldest inhabitant said. On the alluvial flats the sheep had been dying by thousands, for there was absolutely no feed for them. The clayey earth had caked and cracked, and its herbaceous growth had long withered. The poor sheep had crept down to the river to drink, and had not strength to climb back, and so they had died there, and that side of the river was literally fringed with their carcases, some of them tainting the air. It was a sad sight.

Above Morgan the cream-coloured limestone cliffs are crowded with fossils. The upper part contains an ancient bed of oysters more than two feet thick. Some peculiarly notable fossils occur, such as *Terebratula*, *Waldheimia*, *Pecten*, *Spondylus*, many species of sea-urchins, corals, corallines, &c.

In places the fossil shark's teeth could be seen sticking out like steel spikes. The long precipitous bluff is honeycombed into holes, and eaten away into shelves, chiefly by the action of the sun and the wind. These shelves are famous places for carpet-snakes and others, whilst occasionally some of the numerous water-snakes in the river will creep upon the lower ledges for a change. The holes at the bottoms of the cliffs are haunted with myriads of crayfish and prawns, some of the latter being six inches long. The celebrated Murray Cod (*Oligorus Macquariensis*), an excellent fish met with on all the best tables of the Colonies, is caught in great numbers hereabouts. It frequently grows to more than three feet long, and attains a weight of a hundred pounds. It is very beautifully marked, but is rather a poor fish to angle for, as it makes indifferent sport. The Murray Cod is the salmon of Australia.

About two miles up the river from Morgan there is a break in the precipice, where a person can land and examine the rocks, and even make his way easily up to the open country above. I observed numbers of the clay nests of two kinds of swallow—one like those of our common English swallow; perhaps they are formed by the same species. These nests were fastened close against the rocks in numbers, beneath projecting and protective ledges. The others were "bottle nests," or nests with separate, bent-down necks, not unlike those of bottles. In both instances the nests were social—that is to say, were crowded together in large numbers. I could not help admiring the sagacity with which two nearly-allied species of birds had worked out two different solutions for a settlement of the same difficulty.

I made my way up above the cliffs to the fine sheep-feeding country, which extends for miles. Too abundant signs and tokens of rabbits were present at every step. Another pest had made its appearance in the shape of a new kind of thistle, which was said to be spreading with enormous rapidity. I examined it, and found it to be about the most completely armed and protected plant I ever beheld. Its rigid stem, leaves, and flower-heads are thickly armed with prickles like needles. No donkey would ever twice attempt to browse off such a thistle. From the circumstance that the plant is affected by frost, I conclude it may have been introduced from South America.

The "Poison-plant" (a species of *Euphorbia*) grows abundantly on these pastures. It squats and spreads itself close to the ground. The entire family to which it belongs is notoriously poisonous. There is a curious fact connected with this plant—only newly-introduced sheep partake of it, and die in consequence. The older ones bred on the place have learned to know it, and never eat it. By a process of natural selection the more foolish of the sheep have paid the penalty of death, whilst the wiser ones have survived. I was told that this acquired knowledge has now become an instinct, and that the young of the wiser sheep aforesaid never touch the "poison-plant." We have hosts of poisonous plants in England, but our cattle never eat them. The animals of a country and the plants of a country are developed side by side, and grow up together. It is when we disturb this balance that the danger ensues. When sheep and cattle habituated to European plants were brought over to Australia, and turned out to pasture among poisonous plants they had no knowledge of, can it be wondered at that numbers died, or that eventually they came to recognise which was good and safe to eat, and which was not? The wonder is the "silly sheep" have learned such an important piece of economical botany so soon and so well.

I was fortunate enough to find a guide, philosopher, and friend in Mr. Inspector Ewins, who has lived on the Murray for more than twenty years. He is a born naturalist, and an ardent sportsman, as well as a capital bushman, and well acquainted with the songs and cries of all the birds and beasts in the bush. He is also a capital imitator of them, and this was amusingly illustrated when a flock of sulphur-crested cockatoos (*Cacatua galerita*) flew over the river. We were in a boat, and Mr. Ewins imitated the cry of the minar bird which acts as the sentinel to the rest of the feathered tribe, all of whom have learned to recognise the signal that danger is near. No sooner had the imitative cry been whistled, than the flock was instantaneously thrown into the most comical confusion. They flew this way and that, and then settled upon the first large tree. Lower down the river another flock of these birds covered a tree so as to resemble a tree in flower. The Darling cockatoo (*Corella*) is also becoming common hereabouts, and its spread is comparatively modern.

The number of birds we saw amazed me. The air was constantly full of their cries. The parrots and cockatoos were, of course, the most abundant; but we also saw the white and blue cranes, two or three species of hawks, a flock of pelicans, and last, not least, three emus. We had found their tracks, together with those of kangaroos, very numerous in the bush, and I was delighted to see these birds in their wild state.

To wander in the wild Australian bush is a strange and exhilarating novelty to a naturalist. There is a wealth of animal and vegetable life, and all are of such strange forms, that his attention every minute is attracted by fresh ones. The interest is intensified when, as at Morgan, the surrounding rocks are as full of ancient life as is the scrub or bush, or the river gliding through it is with living creatures.

And yet one soon perceives that certain trees and plants repeat themselves until, I dare say, a Colonial comes to regard them as monotonous, and even dismal. One part resembles another, like the patterns of a carpet; and I heard of men who had been temporarily separated from their companions for a few minutes who had been utterly unable to find them again, and had thus got "lost in the bush." One cannot realise the agony included in the meaning of this phrase. As an accident, it is, of course, getting less every year; but we can hear tales of being lost in the bush told by nearly every fireside ingle. In the Murray scrub I heard of men who had been lost for a fortnight, and had nearly died of thirst, although they had actually never wandered more than half a mile from the river. A person, when lost in the bush, is apt to walk and wander about in a kind of mill-horse ring—never really getting far away from the point where he first discovered he had lost his way. A good many unknown skeletons lie decomposing in the unexplored Murray scrub!

The chief tree in the Murray scrub is the "Mallee," whence the common name of the "Mallee Scrub." This is a species of eucalyptus (*E. dumosa*), which seldom grows to more than fifteen or twenty feet high. It is, therefore, an exception to the other species of gum-trees, which usually attain great heights, and one of which, in the Dandenong Ranges of Victoria, *Eucalyptus amygdalina*, has been found 420 feet high. The popular names of the gum-trees are very bewildering to the new-comer. As is well known, the term "gum" trees has been given them from the abundant resinous exudation proceeding from their branches and stems. There are about 140 species of gum-trees, all of them now entirely confined to Australia and Tasmania, except a few species lingering to the north in the Moluccas; although we know from geological records that they lived in Europe during the latest part of the Secondary period, and in England during the early Tertiary.

These trees are marvellously alike, and the colonists usually distinguish them by the nature of their *bark*, which peels off so as to give the trunk a very poverty-stricken aspect in the day-time, and a very weird look at night. The ground around a gum-tree is, therefore, usually littered with fibrous bark, rich in tannin, and, therefore, slow to decompose, which prevents herbage from growing. The calyx of the flower has an elegant cup or goblet-shape, which has earned for all the gum-trees their generic name (derived from the Greek) of "pretty cup." The flowers have no petals, and the numerous stamens are arranged all round the margin of the cup or calyx, so as to give it a very feathery appearance, and to make it resemble an acacia flower. In some species, the stamens are brilliantly coloured, generally orange or yellow (in a Western Australian species they attain an unusually large size, and are of the brightest scarlet), and then the gum-trees look very gay and attractive. Honey is secreted within the cups of the flowers, to which insects resort. Parroquets (*Trichoglossus*) also frequent them for the purpose of securing both insects and honey, and their peculiar tongues, the fibres of whose muscles (so to speak), instead of cohering into one strong muscle, remain uncombined, act the part of a camel-hair brush, and thus enable the bird to sweep out both the honey and the insects which the eucalyptus cups contain.

Doubtless, my readers have heard of the "Shadowless Woods" of Australia. The statement is only partially true—or, rather, it is exaggerated. The gum-trees (by far the most numerous of all, both individually and specifically) break out into evergreen bunches of leaves at the ends of a few forked and terminal branches. This gives them a very "seedy" look, as compared with the lush leafage of English arboreal vegetation in June. The atmosphere of Australia is dry—perhaps a trifle too dry—and the leaves of the trees have not only to get carbon from the carbonic acid gas diffused through the atmosphere, they have to *transpire*, or do the vegetable perspiration as well. In a land where moisture is not abundant, either in the shape of rainfall or dew, it becomes a vegetable necessity for the leaves to economise that which the roots and rootlets have found it so difficult to obtain. If we cannot earn much, the next best thing is not to spend much. The vegetable kingdom adopts the same principle.

If the leaves of the chief Australian trees (and the chiefest are, doubtless, the eucalypti and the acacias) were to expose their flattened surfaces as those of our English trees do, there would be a vast amount both of evaporation and transpiration going on. In reality, the acacias have no leaves, as will be shown presently. But the apologies for leaves possessed by the latter, as well as the actual leaves owned by the gum-trees, have somehow learned the same trick in botanical political economy. In proof of this, I cannot do better than quote what Professor Moseley says on the subject in his charming book, "Notes by a Naturalist on the *Challenger*":—

"Grisebach, in his account of the vegetation of Australia, dwells on the close relation of interdependence which exists between the tree vegetation and the coating of grass which covers the ground beneath it; and remarks, that the amount of light allowed by the trees to reach the ground beneath them is rendered more than usually great by the vertical position in which their leaves grow. Hence the growth of the grass beneath is aided.

"It may be that this permitting of the growth of other plants beneath them, and consequent protection of the soil from losing its moisture, besides other advantages to be derived, is the principal reason why, as is familiarly known, two widely different groups of Australian trees—the eucalypti and acacias—have arrived at a vertical instead of a horizontal disposition of their leaves by two different methods.

"The acacias have accomplished this by suppressing the true horizontal leaves, and flattening the leaf-stalks into vertical pseudo-leaves or 'phyllodes.' The gum-trees, on the other hand, have simply twisted their leaf-stalks, and have thus rendered their true leaves vertical in position. There must exist some material advantage, which these different trees derive in common from this peculiar arrangement, and the benefit derived from relation to other plants by this means may be greater and more important than that arising from the fact that the vertical leaves have a like relation to light on both sides, and are provided with stomata on both faces. In support ot this conclusion, I was told, when at Melbourne, that when the native vegetation was cleared away from under gum-trees they ceased to thrive, and in time perished. I was shown a number of gum-trees, not far from the city, scattered over some public land, covered with only short turf, which seemed to be mostly in a dying condition."

All, or nearly all, of the 140 species of gum-trees have aromatic leaves. Both the popular and the learned names of the species often express the same fact. One common kind is called the "Peppermint Gum," which is about as aromatic a definition as I can think of. The oil-glands which give out the perfume can be seen imbedded in the leaf-tissue. *Perfumes* have a singular influence on the solar heat-rays—they are opaque to them. Consequently, leaves possessed of perfumes are kept cool; and we thus see how those of the Australian gum-trees have not only been mechanically protected by acquiring the trick of turning their edges to the sun's rays, but how they have managed to manufacture perfumes which bar out a considerable portion of the indirect heat-rays by which they are surrounded. Hence their evergreen character—even when the grass and herbage are parched; for the latter are not in the secret!

To the colonists, the abundant perfumes disengaged from the volatile oils of the leaves of the ubiquitous gum-forests of Australia are of immense sanitary value. They affect the condition of the oxygen of the atmosphere, and temporarily convert it into that allotropic state known as *Ozone.* The healthy, joyous nature of the Australian climate everywhere, in any and all of the colonies, is largely due to the ozonising agency of the gum-trees.

The so-called "Mallee" of Victoria is a different species of eucalyptus from that of South Australia, and is known to botanists as *E. oleosa.* I do not know why they should have obtained the same names, for the two species are quite unlike each other. But four or five hundred miles of travel rub out the botanical impressions of non-botanical minds; and so if such people find the same genus of shrubs growing under similar conditions in Victoria as was seen on the banks of the Murray, it is quite understandable that it should receive the same popular name.

The mallee was in flower when I rambled along the banks of the Murray, and I was never tired of examining it. The ground beneath was bare of grass and herbage—the fearfully dry heat of the summer would alone have withered it, and I arrived when the autumn had well set in. It was therefore an interesting time—one to find out which sort of herbaceous plants could best stand the test of an Australian summer. The Spinifex grass had beaten the lot hollow! There it was, as green and innocent-looking as an early patch of English grass in June! It grew in clumps; it was not ambitious; it did not seek to possess the earth—although, if it were so minded, I do not know what is to hinder it. Nothing in an English "green lane" is more comforting or cheering to the eye than this universally-spread and characteristically Australian Spinifex grass.

I should like to write its pedigree and biography. Why should not plants possess both? This genus would tell us of ancient and isolated climatal struggles, in which hosts of botanical relatives and acquaintances had gone down or become extinct,—how itself had learned the trick of defeating and baffling and diplomatically overcoming the niggardly rainfall of an Australian climate,—of learning to secrete green chlorophyll amidst the fearful aridity, just as if the plant were doing so in England during a lushy June! I feel as much sympathy for such brave and persistent endeavours as if the species belonged to the *Zoological* instead of the *Botanical* divisions of organic nature! Why not?

But the Spinifex grass (so far) has only succeeded in lending itself to humanity as an aid to a bad practical joke. You are asked to sit down on some seemingly green, grassy knoll, and you do so—but not for long! Every Spinifex blade is a needle—Birmingham can produce nothing so rigid, so tough, or so penetrating! It would very nearly go through mediæval armour—only I do not know of any mediæval armour invented which would protect the part the spinifex grass usually penetrates in the human system! When young, doubtless many mammals browse even upon this metallic member of the vegetable kingdom, just as the sheep take advantage of the similarly needle-shaped leaves of the gorse, when the latter are young.

The natural history of biology, understood properly (and it is not worth our while living to understand it in any other way) is one of giving and taking, of ebbing and flowing. The real secret is that life is more than matter—just as soul is more than body! And to continue and propagate even lowly-organised types of vegetable life, much skill, diplomacy, and craft have to be manifested.

Out in the wild bush—no man's property—we were like boys! So we got up a bush-fire, and lit a large clump of Spinifex grass. It blazed and crackled, and the fire ran along as if every blade was full of turpentine. Never did I see a more highly inflammable living vegetable substance. My friend, the bushman, incidentally remarked, that he often wondered the grass had never been utilised. Perhaps it will be some day.

The blazing Spinifex soon fired the drooping branches of the mallee gum hanging over it. The leaves of this tree are full of oil, and so they communicated the conflagration, which now ran and skipped and leaped from tree to tree and from patch to patch. A few snakes crept forth, lizards glided, beetles flew about—all as if a real "bush-fire" were on. But the ground thereabouts was too poor and sandy, and the vegetation too sparse, for the fire to spread far; so it died away in about an hour.

Another common plant in the Murray scrub (and, indeed, in many other primitive places) is the Bastard Box (*Eucalyptus polyanthemos*). Here and there we came across the native Pine (*Frenela* or *Callitris*)—a stately but not demonstratively large member of the *Coniferæ*. It was an interesting object to me, because we find its fossil cones in our English early Tertiary deposits. "Ti-trees," or "Tea-trees," as they are more commonly called, also contributed their share to the scrub; but not to the extent I subsequently found them doing to the scrub of Victoria and New South Wales.

But what struck me most then (and the impression gained rather than weakened in its force with further observation elsewhere) was the number, although not the great variety of what we know as parasitic plants. Certain genera of plants seem to have sent some of their species out on begging or marauding expeditions all the world over. Here, in the "bush," for instance, are the "Australian Mistletoes" (*Loranthus*)—first cousins—nay, almost nearer relations—to our English Mistletoes, living after just the same manner! Many of the shrubs and trees were intertwined together in a dense and almost impenetrable mass of slender and tough vegetable ropes—the stems of plants closely related to the *Dodders*, so well known to British farmers.

We did not wander far from the river, and the latter gleamed on us every now and then from its broad, long stretches. But the situation was anything but lonely, thanks to the cockatoos and the corellas. These sometimes made so much row that we almost sighed for the silence of civilisation. The pelicans, cockatoos, white and blue cranes, kept crossing and recrossing the river; and the sentinel minar bird, by his metallic warning note, had appointed himself censor and public adviser to ornithological nature. Happy bird! The bronze-winged pigeons were abundant, but shy; nevertheless, we could distinctly hear their peculiar cries—half sob, half sigh. Indeed, their greetings are among the best-remembered things I have brought home, notwithstanding they were "low and sweet."

For many years past I have been a diligent collector of stone weapons, *Palæolithic* and *Neolithic*, and a picker-up of all sorts of unconsidered trifles relating to humanity. All kinds of ethnological pursuits have long had a singular charm for me, even in the feeble and impracticable way that we follow them at home. Consequently, the fact of being in the

Australian "bush," surrounded by numerous evidences of aboriginal occupation, was interesting beyond description. We did not meet (as had been anticipated) with any camps of black fellows; they were all up at the lakes, we were told. But the large, old gum-trees by the river, and on the alluvial flats, were scarred to a remarkable degree. In some instances the scars left were twenty feet long. Their canoe-shape indicated that the bark had in former years been ingeniously removed by the natives whole, for the purpose of converting it into canoes or "mungoes." I afterwards saw a few trees similarly barked on the Yarra, within the present limits of Melbourne.

About a couple of miles below Morgan we visited an old native camping and burial-ground close to the river. It was to me a touching sight to see the outcropping of fragments of dried human bones and teeth, for the soil in which they had been buried had dried, and then been blown away as dust, and thus the remains were laid bare. Here and there over the sloping and undulating river-bank were scattered heaps of stones, purposely collected together to form hearths, and all of them bore marks of fire. Large quantities of the shells of fresh-water mussels from the Murray (*Unio*) were strewn about—the remains of cheap funeral feasts; for the emotions of sorrow and grief make Australian aborigines hungry, just as they affect the relatives of deceased Europeans, who would think no funeral decent unless there were an abundance of "funeral meats"!

Near Morgan railway-station, on the common-like land which stretches away to the mallee scrub, beyond the scattered houses, were a few significant, if unattractive, objects. These were the grave-wurleys, where several aboriginal chiefs lie buried. Notable among them is the grave-wurley of one of their recent kings. It is a melancholy sight, this, to see an ancient people, whose origin is utterly unknown, wasting and melting away like winter snows before the spring sun. The grave of the king was a simple mound, with a few sticks, forming a rude imitation of the native hut. These were partly covered with rags—the dress of his late Majesty, I presume. On the top of the mound were half-a-dozen large clay balls, each hollow beneath, which had been contributed by his wives. They wear them three or four weeks after their husband's death, and then deposit them as tokens of bereavement on the grave. They are genuine widows' caps, in short, only formed of clay instead of crape, and weighing each about five or six pounds. I borrowed one of them as an ethnological curiosity.

CHAPTER VII.

VICTORIA : MELBOURNE.

I LEFT South Australia with regret, for I made a host of kind friends there, all of whom seemed to do their best to make me comfortable and happy; and sailed for Melbourne in the *Victorian*, one of the smaller of the coasting steamers. We were very full, and the weather was rough and rainy, but somehow or other the kind geniality of the skipper (Captain M'Lean) made us all feel more cheerful and patient. He is a grand old man, and I felt sure, the moment I saw his red-and-white weather-beaten old face, which looked like a very ripe and sound "York-and-Lancaster" apple, that he was just the sort of skipper who would be the last to leave his ship. It was wet and windy during the whole voyage to Melbourne, and we were very crowded, and many people were ill. The captain employed his spare time in bringing out rugs and wrapping the sick children up in them. Notwithstanding his patient kindness, the old man is most familiarly known in Victoria by a nickname which implies both the recklessness and fearlessness which are usually denoted in Colonial speech by strong language.

Early in the morning we passed through the troubled breakers of the "Rip" into the still and placid waters of Hobson's Bay, within the Heads. On the right-hand side the forest-clad hills stretched away. A few fishing-hamlets were scantily mustered on the beach, for the bay is full of fish; although none in Australian waters equal our British kinds. The so-called "sole" in Melbourne market is really a flounder, and "gar-fishes" are sold and eaten in abundance, although people in England will not look on them as food. I must confess, however, that when properly cooked the Australian gar-fish is a real delicacy. The "schnapper" and "king-fish" are larger and more expensive table-fish; and, of course, the "Murray cod" is much sought after, if not always found.

The approach to Melbourne is very disappointing to a stranger. The Sydney people rather crow over the citizens of the former colony on this account. And, indeed, it is impossible to imagine a greater scenic contrast than that presented by the approaches to Melbourne and Sydney. But a great deal depends on which side of Hobson's Bay the visitor reaches Melbourne by. If the southern (usually taken by the largest vessels only), there is a noble undulation of wooded hills; if the northern, after passing Williamstown there is an uninviting level, which by-and-by gets crowded with manufactories, and past these the river Yarra flows, as if its only purpose in this world was to act as a sewer to the great city above, and a drain for the factories below.

I was somewhat disappointed with the river Yarra, but it was not the river's fault. I expected to find it a large stream, something like the Thames or Severn. Perhaps this was due to the notoriety the Yarra has obtained from its association with the great city. Afterwards, when I had explored the river beyond Melbourne, and found through what pretty bits of scenery it passed—scenery which is almost entirely due to the agency of the river itself—I felt sorry I had unconsciously libelled it by allowing my first impression (made as the *Victorian* slowly steamed up the marshes) to hastily warp my judgment.

The City of Melbourne has been repeatedly described, and I do not intend to do other than record my own impressions. England has many great monuments which testify to her greatness and to the overflowing energy of the Anglo-Saxon race; but I know of none which exceed in suggestive grandeur this magnificent city, with its churches, chapels, theatres, schools, and other public buildings; its splendidly-built houses and fine streets, its warehouses, wharves, and shipping; its railways, newspapers, telephonic and telegraph systems; its comfortably-housed hundreds of thousands of human population—all gathered together where less than half-a-century ago there existed the wild wilderness of the Australian bush!

Not even in London, Edinburgh, Glasgow, Manchester, Birmingham, Liverpool, or any other of our great cities and towns at home, shall we find more imposing streets than the chief ones of Melbourne city. Collins-street is the principal, and its architectural magnificence is increasing every year, for the smaller old houses and buildings are coming down, and a bigger and grander kind taking their place.

Land in the chief Melbourne areas is almost as fabulously dear as in London or Manchester—a marvellous contrast with the limitless room of Australia generally. But emigrants are singularly gregarious, and they tend to settle down where they land. They will put up with much inconvenience in Melbourne and Sydney rather than disperse into the thinly-populated country beyond. It seemed to me that this was the weakest—almost the breaking-down—part of the emigrant system. Those who are strong-minded, energetic, and self-reliant enough to leave the ports as soon as possible, and go up country a little way, are sure to be rewarded with well-doing.

Architecturally striking though Collins-street is, the effect is largely interfered with by the spider's-web-like abundance of wires, and the forest of unæsthetic poles which supports them. For everybody uses the telephone in Melbourne, and sixpenny telegrams were in use there before we thought of them in England. I mention this to show the ready and eager use the Colonists make of any scientific discovery or invention which bears practically upon human life.

The "blue-stone" so largely used in Melbourne buildings is a *dolerite*, quarried in the neighbourhood of the city. It is very dark and sombre, and on a wet day Melbourne looks as melancholy as Manchester. The *stucco* which skins over the fronts of many modern buildings in Collins-street is worse still, both by contrast of tint and because it suggests feebleness and "scamping." The main

Melbourne streets are perhaps too wide, for in wet weather their margins are like ploughed fields, and in dusty weather they are gathering-grounds for dust-storms. I would suggest planting rows of trees to break the width and improve the streets.

Australia is the paradise of the working man. He rules the roast; and, as manhood suffrage exists there, and members of Parliament are paid £300 a-year as salary, politicians are apt to appeal to the working men solely for support. It struck me that the young people ate too much animal food, and that this produces a restlessness which is partly worked off by football and cricket. But if they are too carnivorous, the fault will soon correct itself, for the price of butcher's meat is going up, and I found little difference, in the price of the best joints and select pieces, between London and Melbourne. This is almost the only point in which Australians score against the old country, for rent, clothing, fuel, &c., are all much dearer there than in England. It is on the middle-class man rather than the working-man, however, that the difference falls. The former employs a colonial tailor to measure and fit him for clothes, and pays accordingly, for wages are high; the latter buys imported clothing, manufactured by low-waged people at home, and pays little more there than he would here.

"Clubs" are numerous in Melbourne, and nothing can exceed the generous hospitality with which they welcome a stranger. Within twenty-four hours, I was officially advised I had been elected an honorary member of every club in the city for one month! I wondered whether there was a single city or town in England which would have done half as much to an outsider from the Antipodes! Palatial buildings these club-houses are, fitted up with all that architectural art can suggest or luxury require.

Political and social discussion is as freely carried on in the chief Australian cities and towns as in those of the United States; but with much better taste as regards the press. In Parliament, however, I cannot say that a good example was set, either of personal courtesy or choice language. The debates are fully reported, even when personal abuse and slang are freely used; and I was glad to see they were, for there is nothing better calculated to correct it than thus to subject the *modus operandi* of a debased discussion to the criticism of enlightened public opinion.

I was in Melbourne when the Licensing Bill was discussed. I attended one of the evening Parliamentary sittings when this subject was on, and listened with the devout crowd of outsiders, who all took their hats off to hear what their representatives—with their hats on—had to say in the inner circle. The latter showed their extreme and utter independence by talking as much as they liked, which indicated how superior they were to the outsiders who sent them and *paid* them to be there, and who would be ignominiously expelled from hearing and witnessing the bad behaviour of their own representatives if they behaved half as badly. I am not, and never shall be, a politician; and I hope to so order my life in future that no such possible punishment shall be inflicted upon me. The conclusion I brought away with me from my single experience of a Melbourne Parliamentary evening was that there was a good deal more "licence" than "licensing"—notwithstanding that the latter was the term prefixed to a Bill which had been under discussion *ad nauseam.*

The new cathedral was commenced whilst I was in Victoria—thanks to the popularity, eloquence, and ubiquitous diligence of Bishop Moorhouse, since translated to the diocese of Manchester. Neither Melbourne nor Sydney can complain of lack of places of worship, for besides churches innumerable, there are chapels representing nearly every sect in Christendom. In Melbourne, the Jews are numerous, and their two synagogues are commanding buildings. Moreover, they appeared to be much frequented. The Salvation Army seemed to be in strong force; but it appeared to me as if its proceedings were conducted with greater decorum than in England—perhaps because its members are from a more respectable class there than here. One good work they had undertaken, and had told off a contingent of the "Army" to do it—to wait at the prison gates and waylay the criminals whose terms of punishment had expired. They endeavoured to win such by sympathy and loving-kindness, whether men or women; and persuaded them to come and dwell in lodgings prepared for them, instead of returning to their old careers of crime. I was told that this movement had succeeded marvellously; and everybody seemed in sympathy with it, from his Excellency the Governor to some bricklayer's labourers I conversed with. May God prosper any one engaged in so noble a work!

The wealth and commercial resources of a city may be estimated by the number and magnitude of its warehouses and banks, but its actual and abiding greatness must be measured by other conditions of social existence. There must be a certain degree of literary faculty and taste to carry on the work of society for the general benefit—a love of art to sweeten and brighten life; and a spirit of scientific research and enterprise to look out things new and old, and to keep within touch of new discoveries all over the world in this characteristically discovering period. A nation combining commercial, literary, scientific, and artistic activities must necessarily proceed from greatness to greatness—a nation devoting itself wholly or solely to one or the other, whatever advance it may make in such direction, is inevitably doomed to take its place with the extinct civilisations of which ancient Egypt, Greece, and Rome are familiar examples.

It will be observed that I leave religious teaching and theology generally wholly out of the range of the subjects which deal with national vitality and perpetuity. And this I do, not because I deem them to be less important, but in order to place my subject on a perfectly neutral basis. When religion dominates the hearts of men, it manifests itself equally in their commercial, literary, artistic, and scientific callings and tastes.

I therefore hold it to be a great and promising thing for the future, that a city like Melbourne, which has sprung out of the wild Australian bush within the last half-century, can already show a scientific progress which, if not correspondent to its commercial development, is at any rate more fully proportionate to it than is the case with many of our old and densely-populated towns in Great Britain. The accumulation of wealth must always precede the possibility of the existence of a leisured class, which can devote itself to the study and development of literature and science. I do not know any country in the world, however, where the interval between the former and the latter has been so brief as it has been in the Australian colonies.

Melbourne, as the capital of Victoria, has been unusually fortunate in numbering among her scientific chieftains men of such world-wide fame as Baron von Mueller, Mr. Ellery, Professor M'Coy, and Professor Kernot. The history of Australasian scientific development is inextricably bound up with the names of these men. Again, the learned societies of Melbourne are based on much the same lines as those at home. They not only develope native genius and encourage local research, but they are absorptive enough to attract and include among their members any new-comer to the city or neighbourhood possessed of scientific tastes.

The Royal Society of Victoria has long been known in scientific circles in Great Britain and the United States for the large range and high character of the papers read before its members, and published in its *Transactions*. The importance of a society like this is not to be measured by the number of its members. To outsiders, many of the subjects discussed may appear dry and pedantic, but original research must always be dry and pedantic. The discoverer has to persuade others, to explain his discovery, to gain acceptance for it, or for the theory he founds upon it. All this is a very dry process, but it is a very important one notwithstanding. Other countries take note of the papers read. They are actual contributions to human knowledge; and I hold it to be a grand thing that Australia not only raises gold, copper, beef, mutton, wheat, and wool for the world, but that her most highly-gifted sons are joining in the great scientific discoveries which one day the historian will mark as the most characteristic intellectual feature of the age we are living in.

The Victorian Field Naturalists' Society is less ambitious than the Royal, but not less useful. Its papers do not profess to take such high ground, and, therefore, to outsiders the proceedings appear to be more interesting. This society includes a large number of men and women (why not women?) who are interested in the great and elevating scientific questions of the day. The papers read are of a popular kind, and deal almost exclusively with the natural sciences. They lead to pleasant summer excursions, and are, perhaps, flavoured with a little flirting. But if men and women must flirt, I cannot conceive of it taking place under more harmless or innocent circumstances. The cry I have heard raised among outsiders in this respect reminds me of a similar accusation I once heard raised against Sunday-school teachers—that they only went to Sunday-school to pick up husbands and wives! "And to what better place could they go for such a purpose?" was the pointed answer.

In addition to the above leading societies in Melbourne, I may mention the Historical Society, the Medical Association, the Medical Students' Society, the National Agricultural Society, the Horticultural Society of Victoria, the Zoological and Acclimatisation Society, the Geographical Society of Australasia, the Geological Society of Australasia, and the Bibliographical Society of Australasia.

The Melbourne University is situated on high lands outside the city, and is easily reached by omnibus. It stands in its own spacious grounds, and, like the Colleges at Belfast, Ireland, we have the Church of England, Wesleyan, and Presbyterian Colleges, each separated, but all partaking in the general benefits of the adjoining University. The "Wilson Hall" of the University is a splendid lecture-room, as I found when I had the honour to lecture to the University Union and their friends, on "The Origin of the Atmosphere." His Excellency the Governor (Sir Henry Loch) was in the chair, and the Chancellor of the University (Bishop Moorhouse), as well as all the University Professors, supported him on the platform. It was a noble sight, for there were more than a thousand people present; and, as it was a brilliant afternoon, the spectacle was one not likely to be soon forgotten—more especially as it was my last lecture in Australia, and only two days before my departure for England.

Under the teaching of such men as Professors M'Coy and Kernot, natural and physical science must be well represented at the Melbourne University. I was pleased to see it announced in the papers, however, that a Biological laboratory was about to be founded there by Sir W. J. Clarke—a consummation devoutly to be wished. The Technological Museum, under the directorship of Mr. Cosmo Newbery, is a model of its kind, and must be an invaluable institution to a new country. The Museum is fortunate to have a man like Mr. Newbery at its head, for his technological knowledge of scientific applications is only equalled by his willingness to disseminate it, and by his power of interesting students in scientific work. The arrangement of this Museum also is at once full, accurate, and attractive. Technological information is conveyed to the minds of even the most careless of observers without their being aware of it.

The College of Pharmacy is another institution of which Melbourne may be legitimately proud. Mr. D. M'Alpine, well known in Great Britain for his excellent botanical and zoological atlases, was delivering a course of lectures on practical botany when I was there.

The Aquarium may also be included among the public institutions in Melbourne which diffuse scientific knowledge. Unfortunately for myself, when I visited the Aquarium, some of the tanks (especially the small table tanks) were out of order. The water was too green, caused by the too luxuriant growth of microscopic vegetable life—possibly owing to those tanks having been subjected to too much light. But the largest tanks were in excellent condition; the water was clear and sparkling, and the animals appeared healthy and hearty. Pains had been taken to name the objects, and due prominence had been given to the fish, crustacea, zoophytes, &c., from the neighbourhood of Melbourne.

The Zoological Gardens are in a healthy and attractive part of the city, not far from the University grounds, and easily accessible by omnibuses. Australian birds, reptiles, and mammals are well represented, although not to the extent I had anticipated. I have rarely seen caged animals look so healthy or appear so happy.

One of the things which struck me most in Australia was the number of Botanical Gardens. Every little town has one. In England, perhaps, we should call the same places "public parks," "people's parks," "arboretums," &c.; but the Australians prefer calling them "botanical gardens." In reality, most of them are horticultural gardens. The people, who have to pay for the foundation and support of such institutions, prefer to have groups of pretty flowers and elegant shrubs to barbarous scientific nomenclature, and they are quite right. A sweet-briar rose will smell as sweet as if it were labelled *Rosa rubiginosa*.

But it is possible to combine both the public and the strictly scientific views of this question, and nowhere have I seen it more successfully carried out than in the Melbourne Botanical Gardens. These Gardens bear a high reputation all over the world. The name of one of the most eminent botanists of this or any other generation, Baron von Mueller, is associated with their foundation and development. The scientific world naturally expects that a collection of living plants brought together by such a man will possess a high scientific value.

The site of these Gardens cannot for one moment compare with that of the Sydney Gardens. Nature has done so much for the latter—perhaps more than for any other similar Gardens in the whole world. Whatever of picturesque beauty those at Melbourne possess has been very largely imported into them; and more, when we stand upon any of the lawns after entering the gates, and look across the artificial lake in the hollow, itself bordered by hosts of reedy plants, and half-covered with floating aquatic kinds, over the green and swelling uplands, picturesquely broken by clumps of trees of the most diversified foliage, right away to the clustered houses beyond, one has to confess that it is in every respect a very beautiful one; and yet it is all more or less due to the artistic skill and good taste of the present director of the Gardens, Mr. William R. Guilfoyle, F.L.S.

I visited the Melbourne Gardens as often as I could during my stay in the city. They afforded such a delightful retreat from the noise and bustle of the streets. They looked so cheerful and green all through that most exceptional and trying winter. The last time I visited them the Pittosporums were in bloom, and their perfume filled the air with a rich and powerful fragrance, in which honeysuckle and lilies of the valley seemed competing for the mastery. The Magnolias, also, were in blossom, and their delightful odours were only excelled by the cheerful pink and white of their abundant flowers.

The skill with which the Melbourne Gardens have been laid out so as to cause the vast assortment of arboreal vegetation to produce the idea of distance is very striking. Variety is one of the chief charms of the Gardens. Now we are promenading along the well-gravelled wide walks on the highest parts; in a few minutes we shall be walking by the edge of the lake, or sauntering amid the rocks on which the cactuses and aloes are growing so luxuriantly; or else we shall be half groping our way in the "dim, religious light" of the fern gulley, where the water is rushing over the logs of dead fern-trees, and where all the circumstances are as realistic as at Fernshaw or in the Gippsland gorges.

The plants of the southern hemisphere have been particularly attended to, as it is right they should be. The flora of every part of Australia is splendidly represented in the Melbourne Botanical Gardens. Some of the plants peculiar to Australia now—such as the Banksias, Hakeas, Grevilleas, &c.—have a singular charm to a naturalist. He regards them as an educated Australian travelling for the first time regards the places and ruins with which our English history is inextricably bound up. For years past we have been collecting certain fossils in the base of our English Pliocene deposits in Suffolk. They have been chemically and mineralogically transmuted into phosphate of lime since they were living things, and as this mineral is a precious stone to the agriculturist, such phosphatic lumps are eagerly sought after, and ground down into artificial manures. Thus, the living objects of one period become the means of supporting those of a later epoch. Common among such phosphatic nodules are elongated lumps which for a long time were thought to be the vertebræ of fossil sharks around which phosphatic matter had collected; now they are known to be the fossil fruits of a proteaceous tree allied to, if not identical with, the living Australian Banksias, or "honeysuckle," or "bottle-brush" trees, as they are popularly called. Although we find these interesting fossils in the Pliocene deposits of England, we know they were washed out of a much older formation—that of the Eocene. At Bournemouth, in Hampshire, and elsewhere on the Continent, we have a rich collection of fossil plants, many of them belonging to this very ancient order, Proteaceæ, which flourished in the old country and in Europe generally ages ago!

It was with a sort of reverence that I approached that part of the Melbourne Botanical Gardens where the natural order Proteaceæ is represented by living species, collected principally from Australia; but also comprehending species from the Cape of Good Hope, which, somehow or other, may be regarded as a kind of stopping-place during the botanical emigration from the Northern to the Southern Hemisphere of this ancient, singular, and geologically interesting order of still living and flourishing plants.

Had the director of the Gardens laid himself out purposely to interest a geological botanist, he could not have arranged the living species of Proteaceæ in a better fashion. There they are growing side by side—Banksia, Grevillea, Leucadendron, Hakea, Protea, Isopogon, Persoonia, Macadamia, Telopia, Buckinghamia, Stenocarpus, Petrophila, &c. Some come from the Organ Mountains of the Cape; others from the Blue Mountains of New South Wales. Some, like *Stenocarpus sinuatus* (from the northern parts of New South Wales), have developed highly attractive flowers, insomuch that the tree resembles a mass of flame when its floral display is in its perfection; others, like Isopogon and some of the Hakeas, have no particular floral beauty that we should desire them. This same patch of proteaceous plants conveys the truth which runs through the entire organic world, that the race is to the swift and the battle to the strong. Here is the tall and attractive *Grevillea robusta* attaining the magnitude of a forest tree, side by side with its first cousins, members of the same primæval stock, such as the dwarfed Isopogons. Again, what a variation in the shapes and sizes of the leaves, even of the same genus of plants! Compare, for instance, the cord-like, midrib-like leaves of *Hakea propinqua* and of *Hakea ornithorhyncha* with the large, expanded, and hooded leaves of *Hakea cucculata*. One variety of the latter (*Victoriæ*) has even advanced so far in the direction of separation as to develope a showy scarlet in some of its leaves for the purpose of attracting insects.

Nature is like history, she repeats herself. Close by the patch of ground devoted to the growth of the proteaceous plants we have been considering, is another and a larger, where a great number of species of the important order Rosaceæ are cultivated. As we cast a glance at them we see exactly the same variation in size as well as in floral and foliar characters as those we noted in the Proteaceæ. Here are species which have successfully been developed into large trees, like the apple, pear, plum, &c.—others have not advanced beyond the shrub stage as regards size, such as the roses, hawthorns, &c.—whilst by far the largest number are mere plebeians, thankful for their humble life, growing and thriving in nature where their more aristocratic brethren would die, as is the case with the creeping wild strawberries, potentillas, &c. Few modern botanists doubt the genealogical descent of all the members of the same order of plants from a common ancestor. But what periods of time must have passed away whilst these varying characters were being slowly assumed ! What a long-continued struggle for vegetable existence, what continuous endeavours to adapt themselves to those ever-changing climatic and physical conditions which the geologist knows have been going on since flowering plants first appeared upon the earth ! Every common flower, the most insignificant weed, derives a new interest when we consider it in its association with the more successful and highly-developed species of the order to which it belongs.

We see the same result in plants as we do in human society. Some species have become vegetable millionaires, they have flourished so wonderfully; others, and by far the largest number, are plebeians. The world can afford to develope only a limited number of millionaires.

The Natural History Museum at Melbourne is associated with the name of the genial director, Professor M'Coy, who is still at the head of it. The building is rightly and conveniently placed in the University grounds, and its contiguity to the Zoological Gardens renders it easy for both to be visited in the same day. But it suffers from two of the greatest and most serious drawbacks a good museum can be exposed to—want of room and want of light.

Outside the Museum there is a magnificently-prepared and mounted skeleton of the Australian whale (*Physalus Grayi*). It is 90 feet in length, and is certainly one of the finest specimens I ever saw. Its zoological value is increased by its local character, for this whale was found stranded outside Port Philip Heads. Whales of this size do not voluntarily come ashore for scientific purposes every day, and it may be a very long time before another comes. So that I think it a pity this splendid skeleton stands in the open air, exposed to the weather. In a few years it must fall to pieces in consequence.

As one strolls through the great hall of the Museum, and beholds there, gathered together as in a scientific ark, the representatives of the life of the globe, recent and extinct, animal and vegetable, microscopically minute and gigantically huge—one feels that the great life-scheme which geology and biology have worked out is one and indivisible. In this very hall what eloquent witnessses we have to the numerous and vast changes through which the earth has passed. In the middle of the hall there stand the huge skeletons of the Megatherium from South America, and of the Diprotodon from Australia. Both groups were certainly as much once alive as I and my readers are alive now, but an interval of a million of years elapsed between the eras of the two.

The geology and mineralogy of Australia are well represented in the Melbourne Museum. Fossils have been collected, and brought hither from all the renowned fossil-collecting places all over the world of which the student reads in books. I was much interested in the recently-obtained fossil-bones of a large sea-lizard (*Enaliosaurian*), from the Cretaceous beds of the Flinders Range.

The zoological collections are arranged in "provinces," as far as is possible, and Wallace's great zoological divisions are closely adhered to. The Australian mammals are always objects of extreme interest to a naturalist, although the statement often made in works of natural history that they all belong to the *Marsupialia* is far from correct. They include both the bats and several species of mice as well among the land mammalia; and seals, porpoises, whales, &c., among those which have become adapted to live in the sea. One reason why such a great interest is attached to the marsupials is their high geological antiquity. The were the first of the wondrously-diverse family of mammalia to appear upon the earth, and own an antiquity which goes backwards many millions of years. Secondly, Australia has been for ages their head-quarters. There they have been differentiated into the numerous species which the great Australian island-continent now possesses, besides many others which became extinct there during the Pliocene and the Pleistocene periods. They have ranged in size from the Diprotopon, as big as an elephant, to the little Antechinus, the smallest of known mammals, one of which can be put into a walnut-shell. They have been specialised into purely carnivorous, insectivorous, omnivorous, and herbivorous kinds. Indeed, all the differentiations which have been rung upon the higher or placental group of mammalia have been in vogue among the lower or marsupial division.

The first mammals to be created were these now characteristically Australian kinds. They made their appearance in what is now Great Britain during the Triassic period, and they continued to represent the highest forms of animal life, both in Europe and America, during the entire Secondary epoch. In America they are still represented by the living species of Opossums. They lingered on in England through the earlier stages of the Tertiary epoch, when they appear to have given way before the large and varied introduction of true placental mammals. But meantime they had spread as far as Australia, which latter country then became separated geographically from the rest of the world, so that she never became invaded by terrestrial placental mammals like other countries, but retained as her special zoological character the ancient marsupials such as we see represented in the Museum.

The fishes do not stand ordinary animal stuffing, and consequently never look well in a museum. Perhaps the shark family is in some respects an exception to the rule, and the waters of Australia are notorious for the number and variety of these predatory fish, all of which are shown in the Museum. One species, the Port Jackson shark, formerly lived in British waters, for we find its fossil teeth in British strata. Even more interesting are a couple of specimens of a still more remarkable fish, also possessing a geological line of ancestry. This is a freshwater species, the mudfish (Ceratodus). This kind of fish lived in British waters at the beginning of the Lias period—at the very time when marsupial mammals had just commenced their existence in England. We find their fossil teeth in the Aust cliffs, on the river Severn, and there is a splendid collection of them in the Bristol Museum. They have been in existence somewhere ever since then. Naturalists thought they had long ago become extinct, until the late Mr. Krefft discovered one species living in the Queensland rivers. The Ceratodus is a very remarkable fish, in that it has structural relations to the *Amphibia*, of which the frogs are the most familiar examples.

The neighbourhood of Melbourne is full of interest to the geologist and naturalist. The suburban railway system plants him down a few miles away in a few minutes, so that he can choose the hills or the seaside for a few hours' observation, just as it suits him. The geological character of the country round about is both varied and highly instructive. It is not often that such a pocket compendium of geology and natural history is to be found as that which the student can obtain within a radius of about a dozen miles from Melbourne. This comprehends the

Silurian rocks with their fossils, their abounding evidences of disturbance, dislocations, and denudation; the extension and distribution of the Miocene and Pliocene formations, with their enclosed organic remains; the physical geography and geology of such river valleys as that of the Yarra; the age, origin, thickness, and physical history of the great lava-flows, whose harder rocks are locally known as "blue-stone"—these form a long catalogue of subjects well worthy to be studied.

The Silurian rocks of Melbourne are part of the great fundamental basis of the continent. Perhaps this group of rocks enters more largely into the structure of all the great continents of the world than any other. Its thickness is usually enormous, averaging about 20,000 feet, although I am not aware of the thickness in this part of Australia. All of the strata (with the exception of the interstratified masses of volcanic rocks with which they are abundantly charged in the Old World) were formed on the floors of ancient seas as sediments. These sediments represent the wear and tear, by weather action, of ancient dry lands, whose very sites are now unknown. But that those ancient and extinct continents must have been very extensive we know from the great thickness and wide area of the Silurian rocks which were formed of their abraded and decomposed materials alone.

I do not mean to affirm that the Silurian rocks all over the world were formed at the same time. On the contrary, I am of opinion that they were formed at different but representative epochs. It hardly seems likely that the extensive Silurian strata of North America, Europe, Asia, and Australia were all being laid down exactly at the same period of our planet's history. The fact is, the Silurian period in one area was in advance of the Silurian period in another. Possibly the Silurian period in Australia was the latest, for there is reason to suppose that on that side the globe the geological periods have successively been somewhat later than in the northern hemisphere, where all the great land masses are grouped together, and where the greatest crust-movements of the earth appear to have taken place. Indeed, the fauna and flora of Australia, terrestrial, fluviatile, and marine, are nearly all of a belated kind—representatives of forms which belong to earlier periods in the geological history of the Old World.

We can easily see that the Silurian rocks were of marine origin—that they are only hardened sea-mud, in fact. If we examine almost any of the soft shales in a cutting, we find the impressions of small shells (*Rhynchonella*), and such fossils as trilobites, &c. When the foundations for the Melbourne Free Library were dug, numbers of common Upper Silurian fossils were found, among them fossil star-fishes, brachiopods, and trilobites. The remarkable feature about these ancient fossils is their strong family likeness—even their wonderful family relationship—the whole world over. We hammer out of the Silurian strata in England, Sweden, Belgium, Bohemia, North America, South America, and Australia exactly the same species. Even when the fossils from these various areas are named differently, still any geologist can see that such differences are completely lost in the strong family likenesses and relationships.

The Silurian rocks underlying the city of Melbourne tell a wonderful story to the geologist. Like the rest of the strata of this well-marked formation all the world over (except, perhaps, in Sweden and Baltic Russia, where they are horizontal, or nearly so), the rocks have undergone great mechanical and mineralogical changes.

The quartz veins which intersect them, and which elsewhere are the source (if not the origin) of gold, could only have been formed under some of the above-mentioned conditions, for quartz veins are due to hydrothermal action—to the action, that is to say, of superheated water, or superheated steam, charged with silica, after the manner with which such highly-heated water rises in the geysers of Iceland and elsewhere, and brings up silica along with it. If these cracked, and "faulted," and jointed Silurian rocks of Australia were buried beneath overlying strata (as many of them have been), they would be brought within the influence of the earth's interior heat; and silica in the shape of quartz would be deposited in them until every crack and fissure was filled up, and then the rocks would be intersected by these ribs or "reefs" of quartz rock—perhaps containing gold.

There are numbers of places in and about Melbourne where the young geologist may find evidence of the important mechanical alterations which the Silurian rocks have undergone. One of the best is the splendid section laid open in the road-cutting just above the Victoria Bridge, over the Yarra, at Richmond. There the strata are seen standing almost on their edges. They have been uptilted to this angle of position from a purely horizontal one. Towards the middle of the section, all on a sudden the position of the rocks varies, and so do their mineral character. A transverse fissure, filled in with rubble, crosses the rocks there, and separates the two kinds. This is a "fault"—a great dislocation, produced by the strata having been cracked right through during some severe earth-strain, and by one side having been lifted up whilst the other was let down. This dislocation was not produced all at once. It is much more likely that it took thousands, perhaps hundreds of thousands, of years to complete it. In short, this "fault" must have been the focus of scores of earthquakes for ages. Every additional degree of slipping and upheaving must have been accompanied by earth-tremors and earthquakes; and perhaps at that time these portions of the rocks were buried beneath thousands of feet of overlying strata, all of which have been slowly eaten away by the action of the weather of succeeding geological epochs. The rounded outline and contour of the ground beneath Melbourne are not due to any earth-movements, but solely to the carving power of the atmosphere, whose agents eat away the softer parts of the rocks and leave the harder; so that, although all are alike removed in time by this process, there always remains a surface inequality.

In fact, the contorted and disturbed Silurian rocks of Melbourne—now little removed above the sea-level—are but the much-denuded fragments of a former table-land or gathering-ground of hills and mountains. Geological ages have been engaged in cutting them down and reducing them to their present condition.

The surface of the ground does not indicate in the slightest degree that anything unusual has ever taken place beneath; and yet an anticlinal at the Royal Park is simply the core of great folds of strata, which, if they had not been removed by denudation, would have been represented at the surface here by a high hill. The lateral pressures and thrusts represented by these great anticlinal foldings of formerly horizontal strata must have been enormous. The energy was not wasted or lost. Nature is far too economical to waste anything, notwithstanding her seeming prodigality. She is always feeding her multitudes with a few barley loaves and small fishes—and then gathering up the fragments so that nothing shall be lost! In such an instance as the foregoing, the mechanical energy expended in folding the rocks was not dissipated—it was converted into chemical energy, and, as such, helped to harden the rocks, even to alter their mineral characters—to *metamorphose* them, in fact. Hence, we always find metamorphic rocks most developed where the greatest degree of mechanical disturbance has been going on.

Whilst I am speaking of the Royal Park section, let me draw attention to another noteworthy peculiarity visible there. Trailing over the tops of the highly-disturbed Silurian rocks, and increasing in thickness as we go down, is a series of layers of a gritty-looking quartzose, sandy deposit. It fills up ancient hollows in the underlying slate rocks. It is itself stratified, which means that it was deposited in water.

This gritty, quartzose formation cannot be older than the Miocene period—probably it does not date so far back. It lies directly upon the upturned Silurian rocks, as I have above remarked. Consequently, we know that all of these Silurian rocks must have been disturbed, faulted, and have assumed all the physical character they now present, before the Miocene period commenced. Who would imagine that bare and bald rock sections could indicate such events in the physical history of our globe? Between the time when the lowermost Silurian rocks were formed and the Miocene beds were strewn over them, no fewer than eight or nine long extended geological periods passed away. These are represented elsewhere—partly even in Australia—by the deposition of sedimentary strata many miles in thickness. These simple sections show us the oldest and the youngest formations lying together in geological brotherhood; both formed and deposited in the same manner; and both of them the graveyards—the sepulchres—of the life of their time, embedded in them as fossils.

CHAPTER VIII.

THE ENVIRONS OF MELBOURNE.

THE immediate neighbourhood of the city of Melbourne is not picturesque, notwithstanding the well-kept and extensive Fitzroy and other public gardens. But the southern shores of Hobson's Bay contain many beautiful seaside resorts, and nothing can be more English-looking than such places as St. Kilda, Brighton, Cheltenham, &c., where the sands and cliffs are delightful, although the bathing has to be indulged (for fear of the numerous sharks which haunt the waters) within ugly enclosures, like cattle-paddocks.

The shallow sea abounds with mollusca and zoophytes, and in places the strand is densely strewn with their remains. At Cheltenham the half-submerged rocks are thickly coated with the tubes of sea-worms, which make them look like masses of corals. When the worms put forth their tentacles the spectacle is exceedingly pretty.

But within a radius of a little more than fifty miles of Melbourne on the landward side, we have as great a variety of picturesque scenery as the heart of naturalist could desire. This radius includes scenic features and rock structures of the greatest interest to the geologist; and it also possesses indigenous animals and plants, both attractive in themselves, and still more interesting because of their genealogical relationships.

Many of these places are accessible by railways, and nearly all of them by rail and coach. They are much frequented by the Melbourne people, and the field naturalists have many delightful excursions to them. There we get a mixture of the Rhine and the Black Forest combined, and the effect is all the more continental because of the numerous vineyards usually to be met with in these lovely localities.

Lilydale is a place much frequented by visitors, and the famous vineyards of Messrs. Castella are alone worthy a visit. Australia will perhaps be supplying the world with wines after the vineyards of the old world have been exhausted; but, as yet, the Australian wines are new, and mostly lack bouquet. They require age, and only time can bestow that! But gentlemen like Mr. Castella are a gain to the wine trade of the Colonies, inasmuch as they thoroughly understand their work. The climate of Australia, in Victoria, New South Wales, and South Australia, is so marvellously adapted to the cultivation of the grape, that I am not surprised so many energetic colonists have gone in for this fascinating pursuit. Whilst I was in Victoria there was a conference of wine-growers, and their discussions were remarkably well and most intelligently conducted, showing an intimate, and even loving, knowledge of the life-history of the vine, as well as of its enemies. For enemies the Australian vineyards have, in the shape of the much-dreaded Phylloxera, which has done much, and will doubtless do much more harm before it is vanquished. But the Australian wine-growers may take courage. The Phylloxera is chiefly powerful when its victims are weak; and it therefore luxuriates most among the vineyards of France and Germany, where the soils have undergone a thousand years of exhaustion, so that many of them contain too little potash—the vine's favourite mineral food.

The virgin soils of Australia know nothing of such mineral depletion, and the vineyards there have been attacked by an imported, not an endemic, disease.

Apart from the picturesque beauty of the surroundings of Lilydale, the spot is attractive to the geologist because it is a capital fossil-collecting ground. The rocks are Silurian limestones—or rather, Silurian marls; and I was surprised at the *modern* appearance many of the fossil-shells from this (one of the most ancient formations) possessed. They looked more like the fossils from chalk marl than the Silurian forms we are acquainted with, even when the latter are so well preserved as they are in the Wenlock limestone.

An even more delightful neighbourhood is that of Mount Macedon, situated forty-three miles from Melbourne, and now a fashionable district, for his Excellency the Governor has made it his summer seat. It forms part of the Dividing Range, and the hilly country is everywhere densely wooded. The southern slopes are crowded with delightful bits of the most lovely picturesque scenery. The lower levels are occupied with fruit-gardens, among which the raspberry grounds are, perhaps, most important. Raspberry-picking is almost as great a carnival to the lower classes of Melbourne as hop-picking is to the waifs and strays of London. And such raspberries! For size and lusciousness I have seen nothing at our English horticultural shows to compete with them.

But perhaps the most characteristic and unique localities near Melbourne are Fernshaw and Tree-Fern Gully. The former is forty-eight miles from the metropolis (by way of Lilydale it is only forty-three); whilst the latter is only twenty-one miles. At Fernshaw the English visitor sees something of the immense height of the gum-trees he has heard of. Their tall shafts rise like the columns of some Early English cathedral, and many trees thereabouts are more than four hundred feet high. Beneath them grow the lovely tree-ferns, which have obtained for the place its pretty and thoroughly English-constructed name. Some of the tree-ferns are thirty feet high. The tall trees, the tree-ferns, the gullies, and the waterfalls render Fernshaw perhaps the chief attraction of Melbourne. Fern-tree Gully is a much-frequented afternoon's excursion for Melbourne folk. The scenery is very picturesque and striking, especially when the tree-ferns are in the height of their glory.

After short visits to these localities, I was desirous of getting away into less beaten tracks. I knew how crowded with bits of lovely scenery the Dividing Range was; and I determined to make my acquaintance with its numerous gullies and spurs, working from Bacchus Marsh. The latter place is unfortunate in its name, which carries with it the idea of a swamp or morass. Instead of that it is one of the greenest spots within the radius above-mentioned, as well as one of the most diversified in its natural scenery. By-and-by, when the noble bridge over the Werribee is finished, Bacchus Marsh will be still nearer to Melbourne in time, and I shall not be surprised it this district is then opened out for suburban residences.

I took the train to Melton Station, the present terminus, about twenty-eight miles away. The line passes over the flat pasture-lands of the Keilor Plains, from which low volcanic hills rise in gentle swellings. The area is covered with lava and ash-beds, some of the latter having weathered into red soils. It is a favourite hunting country, and the deer-park near Koroit proves that this is the case. Among the most prominent of the hills are Mount Robinson and Mount Atkinson; but we can hardly call them extinct volcanoes, and it seems absurd to think that all these extensive sheets of lava could flow from such small centres, or that they could find fall enough thence to flood the plains with molten rock. They appear to me to be the chief centres of eruption along a possible line of fissures or dykes, whence the molten matter was discharged. Other gentle undulations or hills are noticeable, one of them (She-Oak Hill) occupied with a grove of the singular trees, Casuarinas, which give to it its name. By-and-by we come to the gum-forests, and there alight and proceed to Melton township, about a couple of miles away. It is a pretty and clean little town, on the Ballarat road. When I was there the people were suffering very much from want of water; but there is a good supply to be obtained, possibly at a depth of not more than 80 ft. or 90 ft. below the surface, beneath the "bluestone" or basalt and the bed-rock.

Melton was undoubtedly a thriving place in the old digging days, when everything passed through the town on the way to Ballarat, and some striking stories were told me of the "goings on" in that historic period.

Continuing the route by the Ballarat road the scenery becomes more striking every half-mile. Mount Macedon lifts itself from behind the Dividing Range, the Pentland Hills continue the latter, their unwooded and green surfaces resembling our English "Downs." Mount Blackwood forms part of them.

Suddenly the nearly level road is cut through by a deep gully to the depth of at least one hundred feet, and the Deep Creek runs along the bottom. But there are so many "Deep Creeks" that perhaps I had better call the stream by its unpronounceable native name of *Djerriwarrah.* Now, considering that the aborigines had no alphabet, and, therefore, could not spell, I am at a loss to understand how such barbarically-spelled names ever came into existence! Certainly the natives did not evolve them: Who did?

The section in this creek is very instructive. There we see the lava and ash-beds resting on the upper surfaces of the stratified rocks. The latter are composed of thin flags and sandstones. The shales are bent over on their upper edges in the direction of the valley like fish-hooks, as if some agent like that of a glacier had passed over them. Or, could it have been the flowing lava? At any rate, it suggested to me the appearance of ice action, and that, too, before the last outflow of volcanic matter. If so, then we have in this section the evidences of such extreme natural forces as ice and fire.

A patch of mallee scrub (*Eucalyptus oleosa*) tops the hill on the other side, where also another section is seen, showing the lava-beds resting on the upturned sedimentary rocks. Clumps of mallee also appear along the roadside, both on the right hand and the left.

Presently we obtain a splendid view of the Werribee Valley, with the town of Bacchus Marsh 150 feet or more below, surrounded by fields of lucerne and the greenest of green pastures. The valley is evidently one of ancient denudation, and the descent to Bacchus Marsh is very steep, although along a capital road. Here, again, the lava-beds crop out, and towards the base of the hill we get all sorts of materials mixed up together—pockets of coarse quartzose sand, large rounded boulders of white quartz, angular fragments of dolerite, &c., all suggestive of a glacial moraine.

The sandstones and flags are said to be of Secondary or Mesozoic age, and the remains of fossil ferns have been found in them, allied to, it not quite identical with, the fossil ferns found in strata of the same age at Talchir, in the Indian coal-fields. These secondary sandstones in their turn rest upon the Silurian strata.

In cutting the foundations for the Werribee Bridge, a bed of lignite was passed through. Specimens were shown me which appeared unusually pure. I was aware that fossil Miocene plants had been found in the neighbourhood, for Baron von Mueller had described them, and shown that they were principally plants belonging to the laurel family, differing from living Australian plants, but allied to those of tropical and sub-tropical Asia. Through what wonderful geographical and climatal changes do the geological records indicate our old planet has passed !

Bacchus Marsh, as seen from above, looks wonderfully like the bed of some old lake; but I do not think it is, although it is usually so described. The junction of the Werribee and the Lerderderg rivers has caused such a great local denudation of the strata hereabouts, that a basin-like hollow has been excavated. A good deal of this denudation has taken place since the last outflow of lava, but the valley itself is evidently of much older geological date.

The green pastures are crowded with fine horses, for this is a great horse-breeding station. Enormous quantities of the pretty-leaved English green and white Mary thistle (*Silybum Marianum*) crowd the pastures and roadsides. No domestic animals eat this plant except pigs, and it seems a pity it should occupy rich soils to the exclusion of more profitable food-plants. All the way from Melton the road was densely bordered by bush growths of Cape-weed and Stork's-bill, and as it was a fine, hot day, their brilliant canary-yellow and mauve-coloured flowers formed wonderful sheets of bright colours.

From the town of Bacchus Marsh to the spurs of Mount Blackwood, one of the hills in the Dividing Range, is only eight or nine miles. The road passes through the valley, crosses the River Lerderderg, and then winds up the steep hill-side through grand gum-forests to the bare hill-top, whence we get a magnificent view of the range, and its multitudes of well-wooded valleys far away below. Goodman's Creek is one of these beautifully-wooded gorges. Prospecting for gold has been going on here for some time, and we found several men engaged in driving. The rocks are of Lower Silurian age—the usual Australian gold-bearing rocks—and the adits were driven in the hill-side at the junction of the overlying consolidated quartz gravel and the "bed-rock." The gold lies, as fine dust, in pockets, and sometimes has even been carried down by infiltration into the porous structure of the softest and most-easily penetrated of the upturned edges of the Silurian shales.

Returning from Goodman's Creek along the ridge, a deflection of a mile or two to the left brings us to the lovely valley of Coimadai—once famous for its mineral waters, and now better known for its lime quarries. One side of the Coimaidai Valley is bounded by lava or basaltic rocks, and the other by the gleaming white and yellow of the limestone sections. The mineral springs rise near the latter, and the waters evidently owe their dissolved mineral salts to their percolation through these various strata. There ought to be plenty of natural mineral springs in the varied volcanic districts of Victoria.

CHAPTER IX.

VICTORIAN WANDERINGS AND RAMBLINGS.

IMPORTANT and abundant as are the evidences of recent geological upheavals from the Miocene and Pliocene sea-beds which the low-lying lands of Southern and South-eastern Australia afford us, their interest is, perhaps, exceeded by the history of the great basaltic sheets (or "bluestone," as they are locally termed), and of the volcanic ashes and scoriæ with which they are frequently associated.

There are numerous evidences of two or more periods of volcanic activity along the Southern Australian coasts. One, the earlier of these, seems to have closed the Miocene period; the other probably terminated the Pliocene, or more recent epoch. The Miocene period appears to have been one of singular volcanic activity all over the world. It was then that what is now Great Britain had almost as many active volcanoes as Java has at the present day—when the north of Ireland was flooded with lava-sheets, and the site of modern Edinburgh was the very throat and centre of volcanic activity. Central France was similarly encrusted with volcanoes, whose cones form a special feature in the landscape-scenery to this very day. Belgium—or rather that part of it represented by the lovely Ardennes—was crumpled up like a handful of ribbons. The Deccan of India broke out with igneous floods; Arabia was equally desolated; probably much of Southern Africa experienced similar vicissitudes; and the throes of a shrinking planet were passed on to Australia, to be continued out there for yet another and later period, when the last volcanic throb was felt, and the last lava-flow crept forth.

Hitherto it has been the rule to suppose that a volcano was necessary to produce lava-flows. When a sheet of ancient lava was found, the next thing was to look for and discover the volcano which had emitted it. Not unfrequently any mountain possessed of a conical shape was sufficient. I suppose this is the reason why Mount Buninyong, near Ballarat, was set down as a volcano. Its shape is of exactly the volcano pattern, but, from personal examination, I am convinced Mount Buninyong is not an ancient volcano. All the way up to within 600 feet of the top (and it is 2,452 feet high), it is seen to be composed of contorted and crumpled Silurian shales, traversed by quartz veins. Mount Buninyong is simply a greater outlier of Silurian rocks, capped by basalt. I had not the opportunity of examining Warrenheip, not far away (which is generally looked upon as a kind of twin extinct volcano to Buninyong). Its shape is very similar, and so is its height; but, from what I saw of the latter, I very much doubt Warrenheip's claim to volcanic origin.

I am not disputing the general fact that lava streams usually issue from volcanic craters. The reason why we have volcanoes at all is because the material accumulates around the mouth of some vent. If those materials could only be equally distributed as fast as they were ejected, there would not be formed any volcanic mountain at all. It is now well understood by geologists that floods of lava have frequently, in bygone times, welled up great crevices or dykes, and flowed over and completely masked the surrounding country. A great deal of the lava or "bluestone" of Melbourne and the neighbourhood appears to have had such an origin, and was not emitted from a "crater." We see these igneous rocks in the railway cuttings, or cropping up in stony masses over the Werribee Plains right on to Geelong, and thence extending for some distance inland towards Ballarat.

There is a capital section, showing the relationship of the old contorted Silurian rocks and these recent lava-flows, shown in the railway cuttings after we leave Melbourne and before we reach Hawthorn, about nine miles distant. The lava-sheet is almost entirely confined to the valley of the Yarra. In many places the Yarra has cut its way through the bed of lava. Consequently, the age of this part of the Yarra must be younger than that of the rocks it passes through.

The same is true of the Werribee River, whose sinuous, tree-bordered course passes through both the lava-sheet and the underlying rocks. In fact, all the rivers passing through the plains are young in comparison with the geological age of the rivers which water the elevated plains inland.

Near Geelong we get some patches of Miocene strata, in places full of fossil shells. They are succeeded by fossiliferous Pliocene beds, and all are hermetically sealed up, as it were, beneath lava-sheets, so that we can only see them where the sea has laid bare a cliff, where rivers have cut breaches clean through them, or where the action of the weather has stripped off the more easily-decomposed igneous rock. All volcanic rocks more or less easily decompose. They generally contain a large proportion of iron, which combines with the moisture of the atmosphere (or rather with the oxygen of it) to form iron oxide. In this way the hardest volcanic rock gradually decomposes, and is reduced to an impalpable powder, or soil of a coffee colour. Moreover, many lava rocks are porous or spongy, so that both water and air easily circulate through them, and the destructive action of the latter is thus increased. At any rate, such rocks generally weather into rich soils, charged with lime, iron, magnesia, potash, soda, &c.

The plains in the neighbourhood of Melbourne must have had a hot time of it when these sheets of lava followed each other in successive molten floods. The sea-floors of the Miocene and Pliocene periods had only just before been upheaved, and tacked on as a fringe of new land to the much older and long-denuded Silurian territory. Over this new land herds of now extinct huge marsupial animals roamed, some of them several times larger than the existing great kangaroo. Some of these immense animals were killed during the volcanic outbursts and buried in the ashes; others sought refuge in caves inland, where their bones are found in the floors or "breccias."

Doubtless, much of the new land formed as above-mentioned by slow upheaval was at first covered with marsh and swamp. The older parts of existing rivers had to cut new channels for themselves on their way to the sea. The process was probably so slow, and extended over such a long period of time, that had man been existing at the time he would hardly have known that anything particular was going on.

The newly-elevated sea-bed was from the first the arena of powerful earthquake forces. Indeed, unless these had been in operation there would have been no elevation of the sea-floor at all, and, therefore, no formation of new land. At length the earthquake energy culminated in volcanic manifestations, as it usually does in districts liable to be visited by both. Generally the former precedes the latter, and when volcanic energy is put forth, the greater includes the less, and earthquake shocks pale before the more powerful outbursts of which they were the precursors.

The railway ride from Melbourne to Geelong, and thence to Ballarat, is of the greatest interest to the geologist. Until we commence the steep ascent on the Ballarat line, all the plains are marked with lava-sheets. We leave them immediately we ascend the gradient, and the railway cuttings show us we are passing over an outcrop of Lower Silurian rocks. They are contorted, and frequently much faulted, for these ancient strata have undergone repeated disturbances, and have been partakers in scores of great earth-crust movements. High as the table-land is to which the train has toilsomely brought us, it is a mere fragment of what it once was, for it is these Silurian rocks of Australia which have most suffered denudation.

Rich grassy plains extended on the right and on the left, with Buninyong and Warrenheip visible in the distance. Forests of white vegetable ghosts stretch away out of sight. They are the ringed and now dead gum-trees, got rid of because of the litter of dead leaves and stringy bark with which living gum-trees strew the grass beneath them. By killing the trees, the grass is improved and sheep-feed increased. Perhaps there is no more common sight to the traveller in Australia than these white, naked forests of dead gum-trees, and one feels inclined to wonder what will be the physical effect upon the Australian climate of such wholesale extirpation of native forests. There is no fact better proved than that the vegetation and climate of a country are closely inter-related. It has been proved over and over again—nowhere better than in the United States of America, in some of which, by the way, they are actually planting forests of those very gum-trees which in Australia are being so ruthlessly cut down.

I am no croaker, nor have I any sympathy with croakers. It is infinitely better to have families and happy homes, flocks and herds, and all that make up the genuine wealth of a great nation, than hundreds of thousands of square miles of monotonous gum-tree forest. Owing to her long geological isolation from the rest of the world, Australia, as a continent, has been spared many of the repeated crust movements which the land-masses of the northern hemisphere have undergone. The consequence is that the mountains of Australia are by no means so high as they should be. They were formerly much higher, but they have been lowered by the denudation of millions of years of weather action. Hence, although Australia is situated in the hemisphere where there is a far greater area of water than land, she suffers from insufficient rainfall. If we could only bump up the Australian mountains a thousand feet, this difficulty would be overcome!

In lieu of being able to do so, the question arises as to the ultimate effect upon the existing climate of this country by the clearing of forest and scrub. Now, the real reason why trees have an effect upon climate is because their roots absorb moisture from the ground, and their leaves transpire it into the air. They are consequently the great regulators of the distribution of atmospheric moisture. But it is not necessary for vegetation to assume the arboreal form to do this. Herbaceous plants, if there be sufficient of them, will act as well—perhaps better. Hence the truth of the old agricultural proverb, that "Rain always follows the plough"—that agricultural operations influence the climate beneficially. If this be true, then we may hope that the long-continued droughts of Australia will become modified.

The country becomes more beautiful as the traveller approaches Ballarat. I was not prepared to find so beautifully-placed a town, or one with such delightful environs. It might be a town in the Black Forest, if it only looked a little older, and if its streets were not so wide. The forest-clad hills surround the town on every side; the only naked place is the celebrated Black Hill, whose surface has been repeatedly turned over in the eager search for gold. As we descend from the lovely scenery about Lal Lal we discover a change in the rocks of the railway cutting. The contorted Silurian strata are covered with beds of coarse, gritty sand, each particle a worn and weathered quartz grain. This is one of the famous "auriferous drifts." A little further on, and a little lower down, and we behold the "drift" (some of it of Miocene age, the latest ranging perhaps down to the Pleistocene) capped and sealed down by a layer of basalt or "bluestone." The level ground is riddled with holes, and deserted, grass-grown mounds, as if some gigantic moles had been at work. A feeling of sadness passes through the mind as one gazes upon this celebrated Ballarat goldfield — a place whither so many adventurous spirits were drawn from all parts of the world; where so many hopes have beaten high, and so many expectations were disappointed!

How long must those surrounding hills have stood guarding this very horizon! Here and there, high above the forest-trees, there rise the unpicturesque shapes of tall chimneys and mining-gear, indicating where deep quartz-reef mining is going on. The Lower Silurian rocks—or rather the quartz veins which intersect them — contain gold, originally brought up from still lower depths by hydrothermal action, and deposited (both together) in the cracks and crannies of the slate rocks.

Such is the geological history of the gold-bearing rocks. Then followed ages of sub-aërial action, when the Silurian rocks were laid bare, when the weather wore away the rock-surfaces, and the rains and floods, perhaps snows and glaciers, carried the *débris*—sand grains and clay grains, lumps of quartz and occasional lumps of gold—down to the valleys below, there to rest on the "bottom" or "bed" rock, as the first or richest gold-drift. A physical local change occurs. A flood of lava wells up some wide fissure, and flows down the valley, covering up and protecting the old gold-drift. Another long spell of weathering and waiting, when the old hills are again eaten away by weather action, and the worn and abraded materials are washed down and strewn over the top of the basalt, thus forming a "second gold-drift," usually less rich in the precious metal than the first. Again there is an outburst of lava, and a second sealing up of the gold-drift. Once more a period of rest from igneous action ensues, and the last valley drifts are accumulated. But how much and how long the Silurian hills of Ballarat and the neighbourhood have been wasted and weathered may be gathered from the fact that in places, I am told, the "gold-drifts" attain a total thickness of 1,000 feet.

Beneath these extend the Silurian strata, traversed by quartz veins, the original places where gold accumulated, and from which all the alluvial gold has been derived. To reach these deeply-seated quartz-reefs, shafts are sunk to as great a depth as those of our English coal-fields.

The city of Ballarat is a magnificent one in every respect, with stately houses forming its suburbs, and cathedrals, churches, chapels, museums, theatres, and other public buildings dispersed through its numerous and well-kept streets. I doubt if there are many finer streets in Europe than Sturt-street. Its great width is apparently narrowed by the boulevards of fig-trees and pines. Vegetation luxuriates here; for the locality enjoys unusual rainfall, owing to the neighbouring hills and the height of Ballarat above the sea-level—1,413 feet. Here are chiefly manufactured the locomotives for the Victorian State railways, and there are other foundries besides, as well as woollen-mills, corn-mills, breweries, &c.; so that it will be seen Ballarat is not wholly dependent on the success of its gold-diggings, as many people at home still imagine. The Botanical Gardens are a model of their kind, beautifully kept, and thronged with interesting trees and shrubs. At the further end of the town there is an extensive sheet of water, large enough to hold miniature regattas upon.

Ballarat has an ancient history; for every visitor is taken to Eureka-street, where the unjustly-treated and irritated gold-miners entrenched themselves against the soldiers in 1854. The place was carried by storm, and thirty or forty miners and three soldiers and an officer were killed. I visited the site of the stockade, which is marked by a monument. In the cemetery there are two others, one to the memory of the miners who fell, and the other to that of the soldiers. Time brings with it strange revenges and reverses. The present Speaker of the Victorian House of Parliament was one of the leaders of the miners during the attack, and he lost an arm there! That was a wild time, and I heard many a strange story told about it by former gold-diggers and settlers around the gum-log fires.

The railway journey from Ballarat to Ararat is, for the first hour, through a tame and uninteresting kind of scenery. There is nothing to strike a stranger except the new sense of space, and it is singular how slowly that crept upon one. I suppose it was due to my having always to mentally adjust my sense of distance on small scales, so that it seemed impossible when a certain object, such as a hill, was pointed out as being 50 miles away, that it could be even half that distance. One has to modify a good many mental instincts in Australia. It appeared strange to look north for the sun at noon. The east and the west seemed to have changed places. I found myself inevitably taking the diametrically opposite direction to that I ought to take, especially at night. These new experiences had not had time to be combined into unconscious automatic action.

Notwithstanding the low-lying baldness of the country beyond Ballarat, there is this undefined sense of grandeur, due to the vast extent over which the eye can wander uninterruptedly. Here and there gleam the shining surfaces of water-sheets—perhaps mere swamps, or even altogether dried up in summer, but just now, after the abundant winter rains, they have a temporary existence as lakes. I am aroused from my reflections by my ears and eyes catching the name of a familiar and dearly-beloved place, "Windermere." A splendid lake extends right away, bounded by low-lying hills, some of which jut into the lake as miniature headlands and capes. But I miss the rugged, pine-clad mountains of the locality whose name the Australian Windermere has borrowed—just as one fails to find the hallowed associations with which the genius of Wordsworth, Coleridge, Wilson, and others have sanctified the true "Lake District." Nevertheless, I was pleased to find a Windermere in Australia, and I doubt not the name of the locality was derived from the resemblance of this beautiful sheet of water to its English prototype.

Beyond this place the railway runs through pastoral country, seemingly occupied only with those vegetable ghosts, the ringed and dead gum-trees. Here and there a blackwood tree (*Acacia melanoxylon*) produces an agreeable contrast, for its bright and umbrageous greenery gives it the appearance of an English oak in early summer.

These "Blackwoods," or, as they are also frequently but inconsistently termed, "Lightwoods," are in the winter-time by far the most prominent of all the trees in the pastoral districts, and there is a strong prejudice against cutting them down. Their bright green foliage is denser than that of other trees, and therefore affords shade for sheep in the summer-time, which the gum-trees hardly do, for reasons already stated.

The green foliage, however, is not produced by *true* leaves, but by flattened leaf-stalks or *phyllodes*. Many of the Acacias have acquired this habit of converting their leaf-stalks (by flattening) into true leaf-functionaries, so that true leaves are not required. It is curious, however, to see how every young seedling "blackwood," the first year it puts forth leaves, produces the ancient characteristic, true pinnated leaves; the second year there are fewer of these, and the *phyllodes* appear; the third year *phyllodes* are in the majority, and the pinnated leaves few or absent; the fourth year, probably, no true leaves appear at all. The life of every young blackwood thus recapitulates the life-history of the changes which have taken place in the leaf arrangements of the tribe. No two plants or trees could be more unlike each other than the young and the adult of *Acacia melanoxylon*. Another remarkable fact about this noble tree is, that when the *phyllodes* are unusually attacked by gall insects (*Cynips*), so that their usurped economic functions are interfered with by reason of the shrivelling which ensues, they develope true pinnated leaves at their ends—as if they reverted to the ancestral habit of their class as soon as they discovered the newer arrangement had failed.

Near Beaufort the country is hilly, well wooded, and bushy, and the scenery is most picturesque. In the railway cuttings we perceive the granite cropping out. The much-altered primary schist and shales are gnarled and twisted, rent and faulted, and upturned in the immediate neighbourhood.

When granite comes to the surface, and forms the rocks about any place, it is a sure and certain, and, to a great extent also, a measurable sign of long-continued atmospheric denudation. For granite is a true igneous rock, once in a pasty, if not a molten, condition. But it was in this state under the enormous pressure of overlying rocks, and, moreover, it cooled and assumed its present appearance and mineral structure when the pressure was still there. If the molten mass had cooled without the overlying pressure being present, the result would have been to form some other variety of igneous rock, such as basalt, but granite would not have been formed.

Some granites have been formed under different pressures to others. Thus, those of Cornwall cooled and solidified beneath about 40,000 feet of overlying strata; whilst those of the Highlands of Scotland were formed beneath 56,000 feet. The difference is expressed in the different mineralogical structures of the various granites.

It will be seen, therefore, that in the localities where we find granite there must have been going on very extensive denudation. Many thousands of feet of once overlying strata have been peeled off and carried away to the sea-bed by rivers, there to form strata of more recent date.

The Bush comes right down to the railway—or rather the railway runs right through the Bush. The latter is very dense, crowded with creepers; the gum-trees are laden unusually with those semi-parasitic plants, the Australian mistletoes (*Loranthus celastroides*). Many curious proteaceous plants, both arborescent and arboreal, crowd together.

At Ararat we are again in the presence of gold-mining, as the rubbish-heaps and mining machinery plainly indicate. Here, again, the Tertiary basalts have broken through, and have a remarkable agglomeratic appearance.

I was on my way to the pretty and thriving town of Hamilton, so I had to change carriages at Ararat. The scenery is rather tame for some distance—that is, as long as we are travelling over the outcrops of the Silurian shales. By-and-by we have passed on to quite a different formation. The herbage is richer. The dense forests of dead and dying gum-trees proclaim that there is plenty of vegetable diet. The entire plain from here to many miles beyond Hamilton, is covered by sheets of once molten rock which cooled as basalt. The latter has been exposed to the action of the weather perhaps for hundreds of thousands of years, and has decomposed into a rich brown soil, full of all those mineral salts on which most plants thrive. The number of blackwood trees gives the plain the familiar appearance of a well-kept English park.

On the right-hand side we catch a glimpse of a not distant range of mountains—the Grampians. The rate at which we travel gives us time to study their shapes, and to speculate on the agencies which have carved and sculptured them, as we slowly pass along. It was getting on in the afternoon when I saw them closely, and their peaks stood out darkly against a lovely primrose-tinted sky. They are covered to their very tops with trees, whose green foliage, seen under conditions of fading light, give that remarkable effect which we only find reproducible in a good etching. Some of the peaks of the Grampian range rise to the height of 3,827 feet, such as Mount

William. Their number is myriad. Against the sky-line they looked like the unequal-sized teeth of some gigantic saw. I never felt so desirous of exploring a region before as I did this of the Australian Grampians. What treasures of delightful scenic bits must it not enclose? A week or two after I was there I saw a picture by Guerard of a view in the Grampians. It was a magnificent picture, in which the artist had caught the genius of Australian landscape—namely, its vastness. In this picture, gum tree-clad mountain-slope succeeds mountain-slope—river-like silver threads meander deep down through defiles suggestive of primæval darkness, gloom, and danger, where foot of white man may never have yet trod.

I think the geologists are right in placing the strata of the Grampian Hills as Palæozoic. I do not think that naturalists and geologists can too distinctly bear in mind that the geological periods in Australia which bear the same names as those of Europe very probably occurred later on. Thus the Devonian period in Australia may have been taking place when there was a Carboniferous epoch in England; just as we find the same groups of animals—marsupials, reptiles, marine sharks, and shell-fish and fresh-water mud-fish—still living in Australia; although we rarely find any of them in Europe in strata later than those of the early Tertiary epoch.

But the shapes of these Grampian Hills! How old they look! What thousands of centuries of sun-heat, frost, snow (perhaps glaciers in some as yet dimly-guessed-at geological periods), rain, hail, and wind actions they must have been subjected to. The quartz grains composing these sandstones may have been derived from the decomposition of the granites of which I spoke above. They are rounded and water-worn. They were gathered together along the floors of unknown seas, and chemical action bound them together into these solid, weather-defying masses millions of years ago! The history of the world is a history of taking down and building up, organic and inorganic; the great builder-up being the radiant energy of the sun, which also takes down as well as constructs. Its heat, falling on the exposed surfaces of sandstone rock, causes them to expand beyond the force of the cohesive attraction which has bound them together; and so grain after grain becomes detached and falls down as dust. The wind blows it away, or the rain washes it away. A new surface is exposed and the same results follow. A century slips away—a thousand centuries—and the sun is still engaged in reducing a mountain to dust. The parts possessed of strongest cohesive action endure longest, stand out most distinctly, and boldly form the sierra-peaks of mountain ranges, as they do these of the Grampians.

At Dunkeld one spur of the Grampians has either come as near to the railway as it dared, or else the railway has been taken as near to the Grampians as was deemed advisable. At any rate, the same result follows. We get a good eye-to-eye view of the scenic features and character of the entire mountain range. A lovely place is this Dunkeld, with a name quite sufficient to recommend it, if nothing else. I felt as if I should like to know some of the squatters, whose splendid houses I could occasionally see through the gum-tree and blackwood forests, so that they might ask me to stay with them.

The Victorian range of mountains (after a short interval of intervening plain) continues the strike of the Grampians. But they are far away towards the horizon. Still one recognises by their shapes that they have a geological relationship, and, perhaps, a geological origin identical with that of the Grampian mountains.

Gliding over these plains on the cheaply-constructed railway, we eventually approach the town of Hamilton. Volcanic cones rise here and there in the distance, such as those of Mount Napier and others. Near the railway-station the basalt is seen in huge agglomeratic masses, each mass peeling off in layers like the coats of an onion, through the chemical union of the oxygen of moisture and of the air with the iron contained in the rock.

Hamilton is a pleasant and hospitable town, with delightful surroundings. I was fortunate enough to meet there an ardent geologist, in Mr. Dennant, who is diligently working up the fossils and minerals of this remarkable district.

I was taken to the celebrated Wannon Falls. That goes without saying; for if anybody went to Hamilton and did not go on to see the Wannon Falls, the people would think as little of him as the Sydney folks would if he went to their city and never saw their beautiful harbour. These falls are at Redruth, about a dozen miles from Hamilton. After the first three or four miles, the drive is through undulating, well-wooded, and picturesque country. Nearly all of it is masked by volcanic rocks, which in some places have weathered into loose sand, much sought after for building purposes, and whose local outcrop is immediately indicated on the surface by the luxurious growth of the uncleared scrub.

The valley of the Wannon is exceedingly beautiful. The river was tolerably high when I visited the place. My friends led me by its boulder-strewn, lichen-clad bank, and I was amusing myself with noting the thousands of those carnivorous plants, the sun-dews, covering the ground in places, when the noise of falling waters reached my ears. Looking up I beheld one of the most beautiful and impressive scenes I have ever seen in my life. The river Wannon was going bodily over an undercut precipice. Its waters described a curve as they flung themselves down to a depth of 105 feet. I stood near the brink, and looked down into the dark boulder-bordered abyss beneath. On either side the rocks rose in steep irregularity, and a long and winding gorge received the fallen waters of the river. The gorge is three or four miles in length.

Descending the rocks as well as we could, we made our way underneath where the river came over. This could be done quite safely. We then saw that the water came over a harder stratum of volcanic rock, which has covered up beds of volcanic ashes. The latter are softer, and the spray of the water is constantly eating them away, and is thus undercutting the overlying bed of hard rock. The latter is then broken off in fragments, and the huge masses in the river-bed beneath were all detached in this way. Thus the Falls are constantly working backwards, and the whole of the river-gorge, three miles in length, has been eaten away by the slowly-retreating cataract.

The volcanic lavas and ashes can be easily studied in the section beneath the falls. We see there a hollow wall of rock 80 feet in height. At the bottom lie, embedded in volcanic ashes, the trunks of partly-petrified and partly-carbonised trees, which were killed by the hot ashes descending probably from the crater of Mount Napier, a dozen miles away. There also I obtained fine specimens of the beautiful and rare mineral *Vivianite;* but the collector has to enclose it in dry cotton wool at once, or its exquisite blue metallic lustre will vanish.

Farther up its course, and nearer to Hamilton town, the Wannon flings itself over the Nigretta Falls, an even more beautiful sight than the single leap the waters take at Redruth. The river gets pent up between walls of hard dolerite, so that it roars and rushes in mad fury, and eventually throws itself, churning and brawling, down an irregular precipice, to the river-bed below. Afterwards, in its sinuous course, the Wannon has a remarkably English look, as it flows peaceably through thickets of flags, grasses, and shrubs which line its banks.

The woody country through which the river Wannon flows, beyond Hamilton, protects the native birds from the destruction they have suffered in so many places. Hosts of green parrots and parakeets, of the lovely rosellas, minar birds, Australian robins, &c., abound. As the daylight wanes, the parakeets gather near the roads, scatter themselves over the grass, where those with green plumage are thus protected from sight, and one is half-startled by seeing a flock of green parakeets spring up from beneath the feet. The scrub, which stretches in a narrow band across the road and the country, must be a splendid place for botanising in the early summer-time. That prettiest of marsupial animals, the flying mouse, is still common there, and the neighbouring town boys go thither to catch it.

The first morning I got up early, and went out for a short walk into the park-like country, where the Melanoxylons abound. The scattered suburbs of Hamilton, with their pretty verandahed houses, reminded me of an American town. The crisp morning air was perfumed with the smoke of burning gum-wood; and, although it was mid-winter, there was a joyous and inspiriting sense of physical life in the atmosphere.

An important geological excursion had purposely been got up for me to see the deposits at Muddy Creek, about five miles away. The morning broke down into wet, but we drove off nevertheless, and were rewarded by the afternoon turning out quite fine. Mr. Dennant, the inspector of schools, has been working at these remarkable deposits for a long time, and I had examined the collection of fossils he has so diligently obtained. They were so interesting that I wanted to see the formation at once.

The place where the fossils occur in the greatest profusion is near the junction of the Muddy Creek with the Grange Burn. The creek is a mere brook, across which one can easily leap. But it occupies the bottom of a valley, all of which has been scooped out by sub-aërial denudation right through the thick and extensive sheets of volcanic lava and ashes down to the underlying Tertiary strata. Geologically recent as these volcanic discharges must have been, they occurred sufficiently long ago for all the surface undulations of the country hereabouts to have been carved by ordinary weather-action into the pleasant, rolling aspect it everywhere presents.

We descended a hill-side, through a thicket of Australian shrubs, to where the waters of the creek had cut for themselves a channel out of a bed of tolerably hard and compact cream-coloured limestone. The bluff was about eight feet high, and was crowded with fossil shells, corals, zoophytes, foraminiferæ, &c. Every particle, examined even with a pocket lens, distinctly proclaims its former connection with life. I have seldom seen a more richly fossiliferous bed, or one where the fossils were better preserved. Indeed, their beautiful state of preservation is at first sight somewhat misleading. When I saw the beautiful cowries in Mr. Dennant's collection still retaining the enamelled gloss for which this genus of mollusca is remarkable, it hardly seemed possible they could be of Miocene age, or even of older date.

Nothing could exceed the quietness of the spot by the creek-side where all this marine wealth of a former world was gathered together—where one could pick up or dig out the remains of creatures which were alive, it may be three-quarters of a million of years ago, as certainly as I am now alive myself. The scene reminded me of Crabbe's vivid and forcible lines :—

> It is a lonely place, and at its side
> Rises a rugged rock in solemn pride.
> And in that rock are shapes of shells
> And creatures of old worlds. Whole generations
> Lived and ran, ere man, a worm of other class,
> To crawl began !

The beauty and perfection of the fossil shells here met with cannot be overstated. Among them was the remains of one very large cowrie (*Cypræa gigantea*). Several other species of the same genus are also found, as well as various species of *Conus*, *Voluta*, *Strombus*, and others of bivalve mollusca. The fossil sea-urchins are buried in great force, many of them of tolerably large size, such as *Clypeaster*, *Cardiaster*, *Spatangus*, *&c.* Throughout the stratum the most abundant fossil is a species of *Pecten*, and another of *Pectunculus*, perhaps *P. laticostatus.* Single and double corals, such as *Flabellum* and *Astræa*, were not rare. A magnifying-glass shows that the fine granular matrix, in which the largest fossils were imbedded, was almost wholly made up of the shells of *Entomostraca*, and the still minuter shells of *Foraminifera.*

Fragments of nautiluses, some of them nearly whole, are found in this bed, together with sharks'-teeth, large and small. The latter attain to a large size. I saw one specimen about 3 inches in length. It was exactly identical with the species found so abundantly in our Suffolk "Crag," and which is so well known to geologists by the name of *Carcharodon* *megalodon.* The same kind of fossil sharks'-teeth are also abundantly met with in the Miocene rocks of Malta, and again in the strata of middle Tertiary age in Alabama, United States. Consequently, this extinct shark—larger in size than even the much-dreaded white shark of our times—must have enjoyed a cosmopolitan geographical distribution.

What struck me most whilst hammering and digging out these Muddy Creek fossils was their general *tropical* appearance. No collection of existing Australian marine shells (unless it were one from the most tropical coast, and I should very much question that), would give the student the firm impression that such mollusca, &c., must have lived in warmer seas than those which wash the adjacent coast at the present time. Muddy Creek is forty or fifty miles from the sea as the crow flies.

Further up the Muddy Creek river I saw another and a higher fossiliferous stratum, remarkable for the number of bivalve shells it contained; and also for the absence of the volutes, cones, cowries, &c., of the lower bed. After seeing and working at this upper bed (which in places is almost entirely made up of the most delicate, yet wonderfully-preserved, of bivalve shells), I came to the conclusion that the two strata are of different geological ages, notwithstanding they appear to be one, on account of their juxtaposition. The fossils of these two beds should be kept apart. If they are all huddled together, and considered as one collection, then I can understand why such skilled naturalists as Professor Tate and Professor M'Coy have arrived at different conclusions concerning the geological age of what they regarded as one and the same deposit.

At the junction of these two beds there is a band of brown, glossy-looking stones, all of them formed originally as nodules. I immediately recognised them as similar in appearance to the well-known "Coprolite" stones washed out of the London clay in Suffolk, which are so much sought after in the manufacture of artificial manure, or superphosphate. Mr. Dennant subsequently analysed these stones, and his analysis confirmed my idea. They contain 8·62 per cent. of phosphoric acid, and therefore, seeing that as yet Australia has not yielded much phosphate, this deposit may some day be found of some economic value.

These mid-Tertiary and later Tertiary strata are frequently bored into in deep well-sinking. Near Mount Arapiles they are reached at a depth of 80 feet from the surface. In the Tatiara country they are found at a depth of 150 feet, although the latter place is 160 miles from the sea. The richly fossiliferous cliffs of the Murray, near Morgan (already described), the deposits on the Glenelg (where the upper beds are crowded with fossil oysters), and the beds at Geelong, Crawford, Stokes, Grangeburn, &c., are all of the same geological age.

During the middle later periods of the extended Tertiary epoch in Australia, therefore, all the relatively-speaking low-lying areas were for hundreds of thousands of years the bed of a warm sea, on whose floors the dead shells and corals accumulated until these beds of limestone formed. The sea must then have made its way right to the foot of the Grampians and the hills of the Victorian range, for beneath the lava-sheets which flowed over this Tertiary sea-bed, after it was converted into dry land, the fossiliferous strata must be continuous over a very extensive area. I think this possibility is of great importance, inasmuch as the porous limestone is a capital retainer and accumulator of water, so that borings made through the overlying basalts and volcanic rocks generally, if they pass into this lower limestone, would hardly fail in discovering a perennial supply of excellent water.

CHAPTER X.

AUSTRALIA FELIX.

WHEN Mitchell, the bold Australian explorer, made his way over the Grampians into what is now called Western Victoria, he beheld such a "promised land" for settling upon that he forthwith named it "Australia Felix." And a wonderful country it is for pastoral and cattle-rearing purposes—as green as the Cheshire meadows, but verdant with more abundant grasses, in which the feeding sheep are hidden in the early summer time, and where the plains are bespangled with flowers, before the grass grows so luxuriantly as to suffocate them. From amid these almost level and always verdant plains, thousands of stately trees rise, chiefly Eucalypti and blackwoods; so that for hundreds of square miles the scene is like some ancient English park. The chief reasons for this wonderful fertility are due to the rich volcanic soils beneath our feet, and perhaps also to the adjacency of the coast range of hills, which condense the aërial vapours and produce rainfall.

To the geologist and ornithologist the entire district is full of interest. It is crowded with extinct volcanoes, green with herbage to their summits, and also within their craters to the very bottom. These volcanoes never rise to more than a few hundred feet above the plains, but they are very prominent features in the extensive landscape, nevertheless. The partially-uncleared forests and numerous lakes are the haunts of characteristic wild-fowl and such birds as cockatoos, parrots, parakeets, &c., of which I shall speak further presently. It is a land settled upon by perhaps the most hospitable people in the world, who are full of generous loyalty for the old country, and most of whom are highly-educated and well-read people.

The railway from Melbourne only runs as far as Camperdown — about 120 miles away — although arrangements were being made when I visited the district to carry it farther into the west. Camperdown is a capital centre for working the district from, and is possessed of one of the best hotels in Australia. The journey from Melbourne is through Geelong, and thence over a flat and scenically-uninteresting but fertile country to Colac, an unpretending but attractive town, flanked by the beautiful and extensive lake which bears the same name. The dark Warrion hills form a capital background to the lake scenery. The day I stopped at Colac was marked by cold and stormy weather, and Lake Colac was excited to fury, its waters curling, and foaming, and breaking just as I have seen them on some Scottish and Cumbrian lakes. But whereas the latter are deep, and usually lie in rock-basins whose hollows are supposed to have been scooped out by ice-action, Lake Colac is shallow, although its waters extend over an area of twelve square miles. In the popular mind all these lakes in Western Victoria are ascribed to volcanic origin, and the usual explanation is that they mark the sites of ancient craters. Now, there are doubtless many crater lakes in these parts, but Colac is not one of them. Its depth nowhere exceeds twenty feet, whereas the genuine crater lakes sometimes reach as much as 200 feet.

Another feature about the lakes in this volcanic district is that some are quite salt—salter than the sea—others brackish, and a few quite fresh. It has been the rule to account for the saltness by supposing that the hollows retained the salt water of the sea ever since the latter covered the area. But I do not think this explanation either meets the case or that it is needed. Usually those lakes are salt which have no outlets. They receive accessions of water either from streams or springs, which passes away by evaporation. But the dissolved mineral matters which such waters carried into the lake cannot be evaporated. They are left behind, and saturate the lake water. And it should be remembered that the volcanic rocks and soils abound with soluble minerals. Where these lakes both receive and emit streams, their water is usually fresh, for there is a constant circulation going on. Some years ago Lake Colac was brackish, but this was cured, and its waters were rendered fresh, by making an artificial outlet. The circulation which then necessarily took place altered the character of the water in a comparatively short space of time.

Although the town of Colac has no pretensions to architectural beauty, it is the centre of a very interesting neighbourhood. I was told that the regatta on the lake was a very attractive sight, and I can readily believe it. The public gardens are a model of tidiness and neatness, and come right down to the most picturesque margin of Lake Colac, and walks and seats have been arranged there for the delectation of visitors. The people of Colac seemed very proud of their gardens, and they have a right to be so.

One of the most interesting districts near Colac is the "Stony Rises"—capitally named, for they are ridges of huge stones piled in hillocky streams. After leaving Colac, and passing over the rich green pasture plains, dotted with numbers of the cheerful and shady Melanoxylon trees, all on a sudden we come to the "Stony Rises," occupying an area of about twelve miles by seven or eight. Their undulating ridges are covered with a rank growth of bracken, and the hollow places are occupied by pools. The "Stony Rises" appear to be the result of a sheet of lava, which eventually weathered into the streams of heaped-up volcanic stones, through their softer surrounding materials having been washed or dissolved away.

The "Stony Rises" were for ages the home and the shelter of the wombat (*Phalascomys wombat*), a few of which still survive there, I believe. But it is a grander retreat for the prolific rabbit, for I should say that it would be a difficult thing to drive out the latter animal from a spot where nature appears to have done her best to make any burrowing animal comfortable.

The "Stony Rises" are remarkably picturesque, and furnish "bits" for a genuine artistic study of nature. The huge stones are covered with a rich upholstering of lichens—grey, yellow, and red. The miniature swamps and hollows are margined by borders of emerald-green mosses. The grey stony places are frequently masked with the abundant growth of bracken-ferns, from amid which the weird white trunks of slender gum-trees rise, drooping over them their characteristic thin foliage.

The bracken-fern (*Pteris esculenta*) is as great a nuisance to the agriculturist of these parts as the rabbits are to the squatter. The rich volcanic soils feed it well, and it spreads and develops accordingly. It costs a good deal, both in trouble and money, to keep it down. Burning the fern only seems to make it grow all the more luxuriantly next year; chopping the roots apparently tends to spread it.

I ventured to offer a hint in the newspapers for coping with the bracken-fern difficulty. The so-called "root" of the bracken is in reality an underground stem, or rhizome—the same part which in the tree-fern we regard as the trunk. Within this stem, underground or above ground, there is stored each year a supply of starch and other plant-food. Every year's fronds contribute to the supply. The young opening fronds draw upon the vegetable banking account until they are fully developed, and then they repay the parent by contributing towards the stored-up supply in the stem.

It is evident, therefore, that if we cut or mow down the young, half-coiled fronds of the bracken, just at the time when they are developing, and when they have been abstracting the nourishment from the stem, the latter will be impoverished. If we mow them down year by year the stems must wither and die. They will be quite bankrupt in short, for the mown ferns will have consumed all the available capital. This may seem a rather tedious process, but in a few years it would prove an effective one.

Lake Corangamite bounds the "Stony Rises," and extends almost out of sight like an inland sea. It is a shallow, brackish lake, along whose banks are layers of small shells, which the wind heaps and piles up in singular-looking drift-lines. Mount Poyrndon stands up beyond the "Stony Rises," and looks like one of those well-known scenic features in Central France —the Puys.

The pastoral lands of the country between Colac and Camperdown are underlaid by beds of lava, which decompose into soft rich soils very readily, so that the scenic features of the district, as regards the plains, are all produced by the difference in the degree to which rock decomposition is carried on. Everywhere we see the lichens covering the harder blocks and masses of lava, and these humble plants are engaged in reducing them, particle by particle, into the finest powder. Only give them time enough, and they will in this way completely eat away the hardest rocks, and reduce them into impalpable dust.

As we approach Camperdown, another and more imposing volcano appears, Mount Leura. In the distance similar mountains rise amid the vast plain in every direction.

Camperdown is a cheerful, unpretending, and prosperous-looking town. I have only one fault to find with its otherwise well-arranged municipal government. Everybody there asks you (after you have been twenty minutes in the place) whether you have seen the Royal Park. It is always with a humiliating feeling in my mind that I reply to such questions, stating I have not yet seen the show-places. It would be so delightful if one could only see them before coming out! Unfortunately, you cannot see any places well unless you have time —and the geologist requires that in a large degree (too large for many people).

However, I did get up to the Royal Park. It is a beautifully laid-out place—one that the inhabitants may legitimately feel proud of. It is situated on the top of an ancient volcanic hill, and commands a view the perspective of which is perfectly astonishing to a "new chum."

The view from the top would have been absolutely perfect—perhaps one of the most wonderful in Western Victoria—if it had not been that all round and about the pavilion, pressing quite close upon it, there has been planted a grove of Californian pines. These have flourished amazingly in the fertile volcanic soils. They are magnificent trees, but they interfere with, and in some points interrupt, the panoramic view.

From the top of the pavilion I counted twenty-one extinct volcanoes; and from this point of view the geologist better understands their character than when he beholds them separately. Far away, Buninyong and Warrenheip were plainly visible, and yet they were sixty or seventy miles away, at the very least. Beyond them were the Grampians, faintly blue, with the characteristic cobalt blue of mountains only to be seen in Australia. Towards the sea were the coast ranges, also deepening into cobalt blue, for rain was at hand, and this was the sign that the immense stratum of atmosphere thus looked through horizontally was charged with watery vapour. The extent of land surface visible on my right hand and left combined could not have been less (it was probably much more) than 150 miles diameter.

I had several never-to-be-forgotten days among the extinct volcanoes of Western Victoria. Near Camperdown, of course, Mount Leura is the principal. It is certainly one of the most interesting in every respect of the whole series. Near it there is a series of smaller hills, from which Mount Leura seems to rise. Its crater is exceedingly well defined, broken down in its rim on two sides after the usual fashion. As we drive along the well-kept road passing through Camperdown and skirting Leura, we see numerous quarries and pits opened in the lower beds. Some are massive agglomeratic basalts or lavas; others (only a few hundreds of yards away) are of the finest and lightest of volcanic cinders and ashes.

I stayed some time at the beautiful and delightfully-appointed station of Mr. M'Arthur, at Meningoort, an extinct volcano, at whose base the house is situated. Close by, pits have been opened in the rocks for practical purposes, and there we see both the cinder and ash beds. Our people in England have very little idea of the luxurious comfort and refinement to be found in the home of a Victorian squatter. For a *home* it is, in the extremest sense of that sanctified word. I was told that as much as £30,000 is frequently spent in building a single house. I always pitied the Australian squatters as a kind of exiles, until I was their guest. Then I wished I also were a squatter. But, unfortunately, I have devoted my life to fossils, and weedy plants, and insignificant microscopical animals, which don't pay; and they have devoted themselves to merino sheep, which do pay.

The genial, generous hospitality of the squatters I met; their love of art, of science, of literature; their wonderful intellectual resiliency—all these things impressed me very much. They looked like prosperous men; they behaved as such. Their rosy faces and cheerful juvenile laughter were indicative of happy lives spent in the open air—and such open air! I wished I could export some of it to dear old England, for the benefit of the toiling multitudes in the factories, foundries, and mines. I believe that, as a speculation alone, it would pay as well as Eno's Fruit Salt or "Hop Bitters." (By the way, speaking of the latter, I cannot understand their amazing consumption in Australia, except on the ground that there is a proportionate amount of bad whisky drunk.) But I have no hesitation in saying that the pure, highly-ozonised Australian air, combined with temperance, will beat hollow the too-frequent coquetting with bad whisky and Hop Bitters!

The climb up the grass-clad slope of Meningoort is a very easy and unromantic affair. You can do it without difficulty—even after a good lunch! Just a few hundred feet of slow ascent. Towards the top the hill is covered with "boulders"—masses of the harder volcanic rock, which have been weathered for ages just where we see them. But these hard rocks, once molten, and poured forth in the molten state from volcanoes like this of Meningoort, have not only been weathered *in situ* by the atmosphere—they have had to succumb to other attacks. The latter are those of the vegetable kingdom—not pines, or gum-trees, or blackwoods—but the very humblest and most ignored forms of vegetable life—the lichens.

But the beauty of the artistic upholstery of the volcanic lumps and weathered boulders on the top of Meningoort! For these volcanic bombs and boulders abound in all the elements of plant-food. No other kind of rock is such a "promised land" to the vegetable kingdom. Therefore, the weathered boulders and blocks on the top of this one well-examined extinct volcano are an artistic picture. They are clad—nay, even masked—with a rich and gay lichen-flora—red, orange, yellow, and primrose colours. Every specimen of them was engaged in the geological work of transforming the inorganic matter of the volcanic lump into organic life. The whole history of the world we live in may be generalised into this—from matter to life, and from life to spirit. But the wealth of coloured suggestiveness, gathered up as an artistic harvest on the surface of one of these loose volcanic bombs or blocks, may one day suggest to some Australian artistic genius (long after I have joined the "great majority") lessons of loveliness, of Creatorial care and omnipresence; of tender, Fatherly supervision of even the lowliest types of the vegetable kingdom, such as I can only guess at, but believe in.

The singular and picturesquely-shaped extinct volcano, Mount Leura, at whose base the town of Camperdown clusters, is, next to Mount Elephant, one of the most easily-distinguished landmarks in this interesting country. From one side it seems almost of tripartite shape, and its sky outlines are fringed with margins of scanty gum-trees. Its bright green slopes are bordered with patterns of a warm chocolate colour, where the arable land begins. The well-metalled road crosses its base, and on the left hand lie the quarries opened for obtaining road materials. In one, these consist of agglomerates of lava, and not more than a quarter of a mile away the other pit is worked in beds of fine, crunchy black cinders, showing how various, even over small areas, are the products of these volcanoes.

The ashes in the low hills frequently assume a stratified appearance, and in not a few instances they have cohered into tolerably compact masses, which can be cut out in blocks. Such a rock is locally termed a "sandstone." It is only when the ashes are fine, however, that this stratified appearance is assumed. I hardly think the stratification is due to arrangement in water, but in the air; for I noticed at the crater-lakes of Keilambete and Bullenmerri that this fine-grained sandstone was dipping circularly away from the crater, just as if the materials had been blown out and had fallen all around the mouth, and had arranged themselves at the same angle of rest that moving sand will lie at when it is loosely tilted down a railway embankment.

The underlying base of the green extensive plain of Western Victoria consists of various rocks. In some parts the "bed-rock" is granite. In another part the lava which formerly flowed from Mount Elephant covered the top of the granite, and the two rocks were seen in juxtaposition. I was told that "granite boulders" occurred in a gully on Mr. Wilson's station at Galla, and I went to see them, thinking I had got hold of some evidences of ice-action. But I found something even more interesting, namely, outcrops of the granite, the upper parts of which have weathered where they cropped up into the rounded masses of stones now piled up on one another. Dykes, thick and thin, of felstone and finer-grained "elvan" granite cross the main mass. Thousands—aye, scores of thousands—of feet of rock once lay over this very granite, but it has all been removed by atmospheric action since the granite itself was consolidated.

Many geologists are of opinion that volcanic outbursts usually take place in areas of great and extensive denudation—that is to say, where the rocks of the earth's crust have got thinner through being so much eaten away by the weather. In this way, nature is always engaged in patching up her weak places, and volcanoes and lava sheets are some of the new patches stitched on to the old garment.

I think that the volcanic materials of Mount Elephant were discharged through vents in the solid granite. In Central France there are multitudes of similar hills to those which dot the great Victorian plain, and all of them have broken through the granite.

But I do not think we should confound the heaps of ashes and agglomerates, and the lava-sheets which crept out of these extinct volcanic craters, with the materials which form the plains. The latter have been pierced in places for wells to the depth of 80 feet. The upper beds are usually composed of a fine yellow clay, succeeded by apparently stratified ashes, which in their turn usually lie on sheets of basalt. Here and there we have evidences that the area was subsequently covered by the sea, as near the junction of the upper and lower crater—lakes of Bullenmerri and Gnotuk, for instance, where there is a stratum crowded with beautifully-preserved fossil marine shells, belonging to the Miocene period.

I endeavoured, as far as I could, to make out the relative ages of these extinct Victorian volcanoes. I do not think they were all in activity at the same time, although they belong to the same extended geological period. It seemed to me that volcanoes like Meningoort and Mount Mackinnon are amongst the oldest; and others, like Mounts Elephant and Noorat, the most recent. The former are more weather-worn. Their lava-sheets have decomposed into rich soils, except on their very summits. The latter still show, by their streams of stones, the direction taken by the last lava-stream.

A singular phenomenon occurs in the lava-streams all around the base of Mount Elephant. There are hundreds of circular rings of stones, looking almost as if they were miniature "standing-stones," and I believe some people think they were the work of the aborigines. Few of these circular rings are more than six yards in diameter. They are evidently the last sputtering of the liquid lava, the latter having been thrown into a series of concentric waves, which hardened like the rest, and then weathered into these remarkable-looking rings of stones.

Mount Elephant well deserves its name, given to it originally by the early explorer, Sir Thomas Mitchell, for at a distance its outline, seen against the sky, is very like that of an elephant lying down. Its steep sides are clothed with richest verdure, although here and there the bright brick-red of the volcanic ashes and rocks relieve it somewhat. A few scattered gum-trees and blackwoods on the gently-rounded base seem to add to the height of the hill. It is very easy to climb, and there is an almost perfect crater. The ridge of the crater is quite wide enough for three or four people to walk abreast upon, and the view thence is most magnificently panoramic. Plain stretches beyond plain, all crowded with flocks and herds, and dotted with the stations of the Victorian shepherd-kings. The horizon is bounded on one side by the Victorian range and the Grampians. Thence, turning on one's pivot, we behold the Pyrenees. Buninyong is plainly in view, as also are the Warrion Hills and the extinct volcanoes on the western side. The white houses of Camperdown are gleaming at the base of Mount Leura. The Green Hills, the Cloven Hills, Meningoort, Noorat, and a host of other extinct volcanoes, greened over to their very summits—are all near neighbours. From this point of vantage we can observe the flows of their ancient lava-sheets, and see where they overlapped or met each other, and where bare places were left uncovered by the more recent flows. These places are usually composed of clay subsoils. Water drains into them to form swamps; sometimes such hollows are permanent lakes. They gleam in the bright sunshine like steel mirrors.

The crater of Mount Elephant is the most perfect of the entire series, except that of Mount Noorat. It is even greener than the outside of the hill (which is saying a good deal), for the herbage is richer and denser. As we stand on the edge of the crater, and look down, we can see in the middle the last slow uprush of viscid lava which closed the vent, and then weathered into the heap of stones we behold occupying the greater part of the bottom of the crater. A few sheep are feeding there. What a contrast! Where liquid lava once came welling upwards and flowing outwards, and red-hot ashes were discharged with immense violence, these harmless animals and friends of man are quietly ruminating! It reminds one of that celebrated picture by Landseer, "Peace," where a recumbent lamb is feeding upon the grass which has grown within the interior of a long-ago dismounted cannon.

To a botanist—particularly if he be also a geologist—the trees growing along the interior slopes of this very crater have an unusual interest. In the light of the genealogical histories now being made out by philosophical botanists for plants, there is not a weed unpossessed of novelty. But to see, as we can see, Banksias, casuarinas, gum-trees, melanoxylons, &c., all gathered together by nature to form a botanic garden within the interior of a disused volcano, is interesting indeed. This natural volcanic botanic garden is a highly representative one.

But war—vegetable war—is going on. All around the exterior part of Mount Elephant, and also within the crater, a crowd of new-comers are competing for the mastery. They are vegetable emigrants, some of which may originally have been purposely introduced by man, but it is certain the others were not. Along the outer slopes we have immense patches of the large and beautiful milk-thistle (easily recognised by its green leaves blotched with white), sow-thistles, clover, trefoil, chickweed, storks'-bill, nettles, goats'-beard, mallow, and other common British plants, occupying the ground almost to the exclusion of everything else.

Where the granite crops out there is evidently a difference in the pasturage of the country hereabouts. For the granite weathers down into a coarse sand, intermixed with the barren clay derived from the decomposition of the felspar. There are few trees naturally growing on such an area, and if there are, they are the bottle-brushes, or Banksias. The latter develope those remarkable flowers which have obtained for them their popular name; and as we approach a quarter-acre of such trees we disturb a flock of lovely green parakeets, which fly away, chattering as they go. These birds habitually fertilise the flowers of the Banksias.

One species of that remarkable fly-catching plant, the sun-dew, is so abundant that it reddens the ground. It goes among the shepherds by the name of "The Star of the Plains," and they say it is poisonous to the young sheep, and that the old sheep never eat it.

CHAPTER XI.

A VISIT TO THE CRATER-LAKES OF WESTERN VICTORIA.

I DID not meet with anything more scientifically interesting in Australia than the crater-lakes of Western Victoria. They form a scenery quite novel and original, and are so exceedingly beautiful in their quiet and quaint setting of circular-sloping, well-wooded banks; so placid—except when ruffled by a storm—and steely-grey in colour, that a true lover of nature is drawn to them by a peculiar fascination. There is something pleasurably saddening in their unobtrusive loneliness. And yet, where these quiet and deep waters are now gathered together, there was once the discharge of volcanic artillery. The heavens above have been many a time red-lighted by the glow from these now cold-looking lakes, and streams of molten matter have issued as rivers of liquid stone from these very sites. The gradually-sloping banks of ashes and lava which surround these lakes, and which not unfrequently extend in undulating ridges from one crater-lake to another, have all alike been discharged from these now sealed-up, but formerly open and active, means of communication between the exterior and the interior of this part of our old planet.

Let us first take the two crater-lakes of Bullenmerri and Gnotuk, about two miles from Camperdown. Both are nearly circular in form; both are salt or brackish; and both are very deep. The greatest depth of such lakes is usually near the middle, as we should expect, if they are simply ancient volcanic craters filled with water. Bullenmerri is no less than 260 feet deep; Gnotuk is 150 feet. These two remarkable lakes are separated from each other by a ridge not more than half a mile or so in width, and yet the surface of the latter is 140 feet below that of the former. The waters of both lakes are salt, and yet a fresh-water spring, giving rise to a small stream, issues from the narrow neck of land which divides them. This water is an underground drainage from the porous ash-beds and porous lavas which form the steep ground sloping down to the margins of both lakes.

The greater part of the narrow ridge which separates Bullenmerri from Gnotuk consists of a bed of clayey marl, full of fossil marine shells. The underground-flowing waters cannot percolate through the clay, and so they issue to the surface to form the fresh-water spring. The latter is a source of much local astonishment and mystery, for it seems difficult to imagine how fresh water can come from a bed of rock which separates two great volumes of salt-water.

The fossils in the above-mentioned stratum possess a high degree of geological interest. They occur in abundance near the margin of the upper lake, where they have been washed out of their parent stratum by rain. Here most beautifully-preserved shells may be obtained—fossil cowries (*Cypræa*), cones (*Conus*), *Volutes*, *Pleurotomas*, *Turritellas*, *Trochus*, *Pectunculus*, *Dentalium*, and other forms occur.

I observed that the "sandstone" beds—as the stratified ashes are called — usually attain their thickest development near the crater-lakes, and that they usually occur in greatest thickness on the south-eastern sides of the craters, and even spread out over the plains beyond. The prevailing winds now, I believe, are north-westerly, and such appears to have been the case when these crater-lakes were the mouths of active volcanoes, discharging fine ashes into the atmosphere, which the prevailing winds caught up and strewed most abundantly on the eastern side. At Keilambete, Gnotuk, Bullenmerri, Cobrico, and Elingamite, the stratified ashes or "sandstones" occur in their greatest thickness on the south-eastern sides. At the latter lake, the western side is low-lying, and there we find "bluestone" rock—a solidified lava-sheet, which flowed from the crater in the molten state on that side where it could most easily get out.

Evidently the ash-beds dip away from the lakes, as if they had mostly accumulated there, so that it favours the opinion that these extinct volcanoes were formed on some ancient sea-floor, and that the stratification is due to action of the sea. Some of the unconsolidated ashes are so light and cindery that if they were discharged into water they would have been distributed far and near, so that it is difficult to see how they could have been heaped up in these low-lying piles or volcanic hills.

The volcanic hills stand magnetically either east and west, or north and south; from which it would appear that they were all more or less in communication along some line of subterranean fissure or fault. Perhaps such a communication passes through the Silurian or granite rocks beneath.

Just as the terrestrial extinct volcanoes of Western Victoria are evidently not all of exactly the same age, so the crater-lakes are relatively older and younger. For instance, at the "Sisters," a few miles from Terang, we have the remnants of an old crater-lake. It is now perfectly dried and drained, but the circular walls still more or less surround a part which, until very recently, was an undrained swamp. Outside, a thick bed of ashes contains fragments of marine shells, evidently of Miocene age.

If these crater-lakes were emptied of the water which now fills them, their interiors would be almost exactly of the shape of an inverted cone. The water varies very much in its character. Sometimes it is exceedingly acrid and salt, as at Bullenmerri and Keilambete; at others, it is perfectly sweet, as in the crater-lake at Terang. This relative saltness and sweetness must be due to the same causes as those which produced the saltness and sweetness of the shallow and larger lakes in the Western District. At Terang there is evidently some underground circulation which keeps the water fresh. Occasionally the lake fills and overflows, and this would get rid of the salt.

When we think of these beautiful sheets of water as occupying the cups of dead volcanoes, we are surprised at their sizes. Bullenmerri is about four miles in circumference; Gnotuk is three or four miles round; Terang and Keilambete can scarcely be less; while the solemn and lovely lake of Elingamite, in Heytesbury Forest, is between five and six miles round. Then, again, one cannot but wonder at their almost perfectly circular form. They look almost as if their outlines had been struck out by a pair of compasses.

Many of these lakes are still the haunts of wild-fowl, black swan, baldcoot, ducks, &c., all of which find good feeding in the abundance of the bright green confervæ which flourish in the saltish waters. The gum-tree forests creep right down to their strands, and in some—as Lake Gnotuk, for example—upright tree-trunks rise out of the water at some distance, thereby indicating that the level has altered. In some of these lakes the level of the water is sinking, but in Gnotuk it thus appears to have risen. Here and there ti-tree scrub (*Leptophyllum*) forms bushy thickets, and the sweet-smelling musk shrub (*Aster argophyllus*) lines the low banks with undulating boscage.

Just to return again to what I have called the extinct terrestrial volcanoes,—to distinguish them from these evidently older crater-lakes, whose materials are of somewhat doubtful terrestrial or marine accumulation,—one of the most perfect in every respect, as regards its external and internal shape, and also the distinctness with which its ancient lava streams can be traced in their flow away from the crater, is Mount Noorat. The lava streams are wonderfully fresh and distinct, and when a piece of the rock is broken through it looks as if it were a fresh clinker from some iron-foundry. The gas-bubbles in the rock are elongated in the direction taken by the flow of the once molten stream. There is an abundance of volcanic minerals in these Noorat lavas of various colours—green, white, black, and iridescent, and it seems a pity they are not collected.

The volcano has two craters, but the principal one is the finest in Victoria. As we stand on its external wall and look down, the sight is very impressive. It is about 400 feet deep, and nearly two miles round. The interior goes sloping down to the centre, like the interior of a conical wineglass, and it is occupied by gum-tree forest and bracken all the way.

Will these Western Victorian volcanoes ever break forth again? This is an important question to ask, although it is a difficult one to answer. I have already shown that this area includes two periods of volcanic activity—or, rather, it may have been only one more or less continuous period, extending over long eras of geological time. Again, I am of opinion that these volcanic outbreaks were connected with the elevation of this portion of Australia from the Miocene sea-bed.

The rule is that volcanoes are only energetic when they are situated near the sea. The farther an extinct volcano is removed from it, by slow upheaval of the land, the less likely it is to break out again. I think, therefore, there is no more reason to suppose these Victorian volcanoes will burst out again than that those of Central France will. Volcanoes, it is true, have their periods of infancy, maturity, and old age; but it does not follow that every newly-born volcano will arrive at the latter stage, any more than that every baby will grow to be an old man or an old woman! Therefore, I believe that these Victorian volcanoes are "dead babies"—an illustration of "infant mortality" which prevails in the inorganic as well as in the organic world, and to which volcanoes are subject as well as men.

CHAPTER XII.

THE VICTORIAN FORESTS.

RUNNING more or less parallel with the coast from Geelong towards Warrnambool, we have a strip of primæval Australian forest, about 200 miles in length by about thirty in width, known as the Otway and Heytesbury forests. A few settlers have invaded it, and are engaged in the difficult task of clearing it from the western side; but the main area is still as wild and natural as if white men had never taken possession of Australia. Here the dingoes, kangaroos, and emus still hold out. It is almost their last refuge in Victoria. A few more years, and they will have joined the mysterious group of aboriginal animals which have become extinct within the period of written history.

My friend the squatter, at whose hospitable home I was staying, not satisfied with having conquered the country where his station lies, more than forty years ago—a country then nearly as wild and forest-clad as the above-mentioned tract, has in his latter years gone in for clearing a patch in the forest. He invited me to go with him to see it, and to stay there all night. I was only too glad to go. We had about eighteen miles to drive, and the road towards the end of our journey was, I was informed, a "real forest road." I had not been aware that it was a road at all! I had discovered it was very lumpy and crab-holey. The locomotion seemed to me like taking horseback exercise in a buggy. Neither myself nor my friend are "light-weights," but we bounced about as if we were india-rubber balls. Everything else in the vehicle bounced about also. When the bouncing was at its climax my friend and driver remarked, "I hope you don't mind it, but that's a packet of dynamite, about 5 lb. of it, on the bottom of the buggy, underneath you!"

I assured him that I had no objection whatever; that I was very fond of dynamite—indeed, that there was nothing on earth I liked better! But I was very glad, for all that, when I saw the dynamite taken out of the vehicle for good.

The dynamite was brought in order to split the numerous and huge dead gum-trees, so that they could be all the better fired, and the ground thus cleared.

We got into the forest and passed Lake Cobrico—an ancient, circular crater-lake, of whose waters only one portion now remains collected in the deepest part of the crater. The rest is swamp, much of which is drained and cleared.

It is good for an Englishman to come out into a district like this. He then learns how much has to be done before wild nature becomes docile and tame, how the forests have to be cleared, the scrub removed, the trunks burned, the stumps and roots pulled up, the swamps drained, the roads made, and how there is nothing else which can do this except strong human hands, moved thereto, and supported in the often-disappointing work, by still stronger human faith and perseverance. All of this is now going on in the forest, and I was a witness of it.

Of course, it is all more or less simple and plain now. There are no natives to spear a man, burn his hut, or to steal his cattle. All that a man has to do is to work, to work hard, and to continue working. But in the ancient history of the colony (less than half a century ago), all the clearing and settling had to be done amidst hostile natives, insomuch that a man could not go for water without taking a gun with him.

My English agricultural friends know very little of the hard labour and great expenditure requisite to keep an Australian "station" in good condition. One of the squatters with whom I stayed (and whose station is by no means the largest) told me he had fenced no less than 100 miles of it, and that it had cost him £80 a mile.

Our route to the forest lay along grassy, unused, one-chain roads, along which waggons and other vehicles were in the habit of winding their devious ways. In many places it was a euphemistic form of speech to call them roads, for they differed from the rest of the country in nowise, except the rough fencing on either side. Gum-trees, dead and living, and also abundance of tree-stumps, of all sizes and in all positions, crowded the "road," along which, I hope, few people are obliged to travel by night. Processions of dead trees—studies in black and white—seemed to pass us by as we drove along. They are the scarred remnants of bush-fires, and they alone are sufficient to mark the road. Flocks of brilliant green parakeets (*Pezoporus formosus*) rise up from beneath our horses' feet; lovely lowry, rosella, and Blue Mountain parrots flash across us in the sunshine like living gems; crowds of cockatoo parrots (*Corella*) soar above our heads, numbers of white, sulphur-crested cockatoos (*Cacatua galerita*) screech as if a screeching-match were on, and every bird was confident of winning. They fly from dead gum-tree to dead gum-tree, and cluster on the branches as if the latter had broken into blossom. All along the road the Australian robins (*Petroica phœnicia*) precede us, flitting from fence-top to fence-top, and turning their glowing, incandescent red breasts towards us, as if they were asking whether our humbler English robin red-breasts could equal them. The crow-shrikes, or magpies (*Gymnorhina leuconota*) (surely the most delightful as well as the most useful of Australian birds) were everywhere, basking and frolicing in the sun like so many kittens, and piping their lovely flute-like notes like the half-forgotten refrain of some old song. The pretty but more silent and smaller magpie-larks were almost equally numerous. Occasionally we got a glimpse of the male of the beautiful blue wren (*Malurus Gaulus*), but he was too proud to show much of himself. The yellow wrens were not half so shy or so scanty, whilst the flycatchers were abroad and busy in great force. The black crows (*Corvus coronoides*) had possession of the semi-cleared country, except where a few jays disputed with them. Overhead a pair of kites or an occasional hawk soared and screamed. But the parrots and parakeets and cockatoos were by far the most numerous and varied of all the feathered tribes, as it is right and proper they should be in an Australian forest. In one place a number of those stately grallatorial birds known as "native companions" (*Grus Australianus*) were going through all the movements of a quadrille party, bowing to each other, retiring, advancing, and retreating, as if to some unheard music. They are handsome birds, for their crimson heads contrast well with the generally French grey plumage. The ordinary blue cranes were not uncommon, plovers or curlews were numerous, and we saw a few of those much-sought-after birds, the bustard, better known to sportsmen, perhaps, as the "turkey."

The forest grew denser and swampier as we penetrated it. There was a thick and almost impenetrable undergrowth of young gum-trees, epacrids, myrtaceous plants, prickly acacia, climbers, and bracken ; and one felt what a capital haunt and breeding-ground such a place must be for snakes. One had to reverse the old proverb about not being able to see wood for trees; here we could hardly see trees for wood.

Snakes are gradually getting scarcer in Australia. A war of extermination is being waged against them, which is getting hotter and fiercer every day, for there are more people joining in the attack. The more a country gets cleared for pasturage, the less are the chances for snakes. They are then more easily seen by their natural enemies, among which, perhaps the most deadly, is the laughing-jackass (*Dacelo gigantea*) — a kingfisher which has taken to killing and feeding on snakes instead of on fishes.

We arrived at a clearing in the forest, where there are one or two small but comfortable wooden houses, at one of which we passed the night. A good many half-wild cattle roam about (my friend owned 2,000). They lead a semi-savage life, a few being trained to come near the station to be fed and milked. A number of rough forest horses, brought up in a similar way, also hung around the place. We mounted two, and rode about eight miles into the more unfrequented parts, where the kangaroos still abound. They had recently been much disturbed through rabbit-shooting; but I saw two red wallaby kangaroos and one "old man" (*Macropus major*). I had never seen them before alive, except in menageries and zoological gardens, and, as a naturalist and geologist, I was therefore deeply interested in seeing them in their native haunts. They are the oldest race of mammals in the world, and lived in England during the Secondary period, which must have been many ages ago.

The way these animals leaped away and escaped in the scrub, almost in the twinkling of an eye, was a caution. It seemed impossible that a pair of limbs could be specialised to such a rapid and powerful motion. Presently other species of marsupial animals were noted. An opossum (*Phalangista vulpina*) was caught in the very act of climbing a tree ; three or four specimens of bandicoots (*Perameles*), one with young ones in her singular pouch, were captured by the dogs, and my diligent outlook for the kangaroo bear (*Phascolarctos cinereus*) was rewarded by discovering one in the fork of a half-dead gum-tree. His light-grey furry coat was exactly of the same shade as the bark of the tree, so that he is admirably protected thereby. He looked down from his point of vantage with such a serio-comic expression that I could not forbear laughing, but he never moved a muscle.

"Cats," as the carnivorous marsupials are called in Australia (*Dasyurus viverrinus*), are very abundant in Western Victoria, and I frequently saw their white-spotted carcasses lying about stations, where they had been killed in traps.

It was full moonlight during the nights I spent in the forest, and I enjoyed the weirdness of the situation as a new experience. Many a time during the evening I went out into the open air, so as to more thoroughly allow the surroundings to impress me. There was a cloudless sky, and the black and white dead trees, some spreading out their naked branches like spectres, others lying in every direction upon the ground, just as they had fallen, added to the ghostly situation. A loud chorus of cicadas and frogs filled the air with unceasing noise, and the laughing-jackasses were more numerous and more noisy than I have known them anywhere else. Every tree seemed to have its pair of them. There appeared to be a competitive examination in laughing going on —a sort of avian handicap. These laughing duets appear all to have been written from the same score. There is the soprano and the baritone, the latter an unmusical cackle, the former occasionally rising to a theatrical and very stagey laughter. All through the night these birds kept up the sport, nor did they seem to be tired of it the next day. The crow-shrikes, or magpies, were also affected by the brilliant moonlight, and every now and then one could hear their flute-like cadences amid the dramatic laughter of the jackasses.

Next morning I rode to Lake Elingamite, a few miles away in the forest, through swamp, thicket, and scrub. It is a lovely lake, between five and six miles round, and its well-defined crater-lip is covered with dense forest and bush. Black swan (*Cygnus atrata*), wild duck, the singular mountain duck which nests in trees, coot, and other aquatic birds were in the greatest abundance; but they seemed quite fearless, and took no notice whatever of us. It seemed a pity to disturb them—they represented the quietness of the scene so well, so we let them alone. The forest grows wilder and denser beyond Elingamite, where, as yet, the hand of the selector has not interfered. But the day is coming when the land will be cleared, as other parts have been cleared, when grass will take the place of bush, and sheep that of kangaroo.

Western Victoria is greatly troubled with rabbits. My squatter friend told me he poisoned 4,000 in a paddock of 600 acres in the space of four days. Indeed, in some places the squatters are carrying on a conflict with these weak little animals which promises to cost as much as a little Russian war. Nature has many strange ways of meeting a difficulty. To one species of animal she gives strength, as to the elephant, for the propagation of the species;

another possesses fierceness, as the tiger; a third species is endowed with speed of flight—as the antelope, for instance. Similarly, the little rabbit—hitherto regarded as the very type of weakness and harmlessness—is possessed of such enormous powers of reproduction that, as a species, it invades the territory of the strong, the fierce, and the swift alike.

The rabbit can breed all the year round in Australia. In Europe it is limited in this respect to eight or nine months. I know nothing more astonishing in practical natural history than the quickness with which the rabbit gathers up experience and utilises it. With us at home the rabbit lives a rather humdrum kind of life—in Australia it has the world to choose from, and it usually chooses the best part of it. In England the rabbit is a strict Conservative, never altering its foreign or domestic policy; there, it is an out-and-out Radical, going in for new measures and new habits every day. It may sound like drawing a very long bow when I tell my English farming friends that out in Australia the rabbits climb walls, and run up hollow trees like opossums—that they even take to the water and swim across rivers; and yet every Australian squatter knows that this is the case. Again, how remarkably sheep and cattle have learned to adapt themselves to partaking of plants in Australia which they would never look at as food at home! The much-despised thistle is now, in many parts of Australia, a friend rather than a foe, for sheep and cattle will eat the head when they are short of food, and it has doubtless saved many in times of drought. The fox has changed both his ideas and his tastes; he now prefers young lambs to poultry, and allows the rabbit to go scot-free. The latter is too much trouble to catch, and is not worth going after. Consequently the English fox is assuming the propensities of the dingo, to which it is zoologically so nearly allied. The English hare, introduced into Australia, grows to sixteen pounds weight; it brings forth five, and even six, leverets at one birth; and when hunted will take to the earth—thus in various ways approximating to the habits of the rabbit. Even the European honey-bees in Australia are running contrary to the traditions of the family as flower-frequenters. They there visit the flowers of grasses, unattractive though they are, for the sake of their abundant pollen. Perhaps, at some distant period, the floral characters of the grasses may be altered and modified, in consequence of their being unexpectedly fertilised by insects instead of by the wind.

These, and a good many other natural history questions, have assumed both a scientific and economic importance within the last few years.

CHAPTER XIII.

COBB'S COACHES: ON THE ROAD.

THE rambles of a home visitor in Australia would be incomplete without a journey in Cobb's coaches. Indeed, one could hardly understand how completely figurative the word "road" is in some parts unless we went by coach.

Nevertheless, it is a bracing, and even a mentally invigorating exercise to get the box-seat on one of the best of Cobb's coaches, behind a rattling good team of four horses, tooled by a capital whip, and on such a splendid bit of metalled road as that which runs from Camperdown to Terang. The scenery is not striking. There is the everlasting monotony of the dead, dying, and living gum-tree forest. About half-way I spied three or four deserted mia-mias, or native bark huts, and the ashes and other evidences of recent habitation showed they had only just been deserted. A few weeks before I had heard of an encampment of aborigines near Meningoort, and went to see them. To an ethnologist fresh from home, I hardly need say that the opportunity of seeing a native encampment was a thing not to be missed.

There were five bark-built huts, with small fires burning in front. The blacks, of course, did not expect us. They were encamped near Blind Creek, right in the midst of the gum-tree forest. The latter is composed chiefly of dead or ring-barked trees, biding their time for ultimate decay and extinction, just as these aborigines are; but they formed a weird setting to the scene. As if to render all the surroundings more dramatically correct, a skinned opossum was hanging in front of one of the mia-mias, and the feathers of some native companion birds lay strewn all about. The women were making baskets, and the "chief," who bears the proud title of "King Billy," was giving the last touches to that characteristic Australian weapon, a boomerang. He subsequently made several shots with it, and it was most interesting to see what a utility-weapon the boomerang is in the hands of a skilled native. The ability to use them, however, is now fast dying out, for the young aborigines don't require boomerangs. So they are now made, like the Yorkshireman's razors, not to use, but to sell.

The road beyond Terang to Warrnambool runs through some pretty but monotonous bits of scenery. By this time I had, of course, got used to meeting that other characteristic Australian production, the "Sundowner"—a ne'er-do-well who prefers to live at other people's expense, rather than work for his own living. The colonial designation is a happy one, for he generally comes to some solitary station just when the sun is going down, to solicit a night's shelter. He leaves next morning for another station, and sleeps away the time under trees meanwhile. He does not need his swag and his billy to indicate what he is—the hangdog, soulless look of his face is enough. What a life to lead! But I was informed, on good authority, that the "Sundowner" is getting rarer. By-and-by he will be supported for the sake of the "good old times," like Edie Ochiltree, in Scott's "Antiquary." Another and a better feature along the sides of these Australian bush roads are the neat and comfortable State schools. Long may they flourish! But I should be sorry to see the day come when parents delegate the whole duty of training, or even instructing, their children to paid teachers alone. Yet it seemed to me that such is becoming the case. If so, it accounts for the lack of *reverence* which appears to distinguish the Australian youth.

As we near Warrnambool the character of the scenery changes, and this is always a token to the geologist that he is coming on a different geological formation. The Miocene beds skirting Warrnambool rise into lovely, rounded, grass-covered hills, which resemble the Sussex Downs upon a small scale. Warrnambool is a fine town, and I was much impressed with its wide streets and imposing buildings.

Not far away is an extinct volcano, Tower-hill. It is trenched all round with water, which occupies the depression, and thus gives to this hill a most remarkable scenic appearance. Tower-hill alone is worth going to see. As we drive to Belfast past Koroit, through one of the most diligently-cultivated parts of Australia I have yet seen, we get an excellent view of Tower-hill, and its peculiar natural moat.

From Belfast to Portland the road is nearly as primæval as the country it passes through. It is fairly good for some distance from the former town, whose Irish name indicates the character of the original settlers. The suburbs wonderfully reminded me of a well-to-do little town in the north of Ireland. The same kind of houses and potato-patches, the same paddocks with the same kind of cows, and the same kind of stone-walls. True, the abundance of that first cousin to the tomato-plant, the pretty-fruited Kangaroo apple (*Solanum aviculare*) undeceived me; and the grassy uplands beyond, with their clumps of melancholy she-oaks (*Casuarinas*) brought me still further back from Ireland to the antipodes.

And even if this had not done so, Cobb's coach would not have failed in being successful. It is not a coach so much as an ingenious bumping-machine, capable of well bumping persons over one of the worst roads in the colony. I found the journey a capital means of discovering that my liver was still in existence, but I shall never resort to the same experiment again. The day was alternately wet, cold, and gloomy, and then fitfully bright and warm. There were only two passengers, myself and a very genial and intelligent commercial gentleman from Melbourne. The coachman was a good-humoured, well-fed young fellow of twenty-two. He was whistling and singing all the way. If I asked him a question (and I occupied the box-seat, which carries with it the right of doing so), he would break off in the middle of a stave and answer me, and then pick up the note where he had dropped it. Nothing came amiss to him—Salvation Army and music-hall ditties wore the same sacred aspect—they both helped him to get through a monotonous life happily and cheerfully.

The so-called road is being mended in the worst and swampiest patches. There is an abundance, a superabundance, of good water thereabouts, all running to waste. Beyond Yambuk, to which place the road is very decent, the running away of the fresh water Australia requires so much is very striking. The conservation of the rainfall, and the scientific endeavours to retain and utilise it, is a problem of the vastest interest to that country.

A few miles beyond Yambuk and we are away from civilisation. Swamps, watercourses, forests of coast honeysuckle (*Banksia integrifolia*) and she-oak repeat themselves. At length the scenery and the vegetation both change. Before we reach Narrawong we pass through a lovely bit of heath and forest country. The ground is a perfect carpet of white, pink, and crimson epacrids, of yellow and canary-coloured acacias, and of low, shrubby Banksias or "honeysuckles." The atmosphere is perfumed with the almond-like perfumes of the blackwood (*Acacia melanoxylon*) and the wattles. The wattle-birds (*Anthochæra carunculata*) are calling to each other in notes which remind me of our English thrush. Bevies of grass parrots (*Pezopœrus formosus*), and the still-prettier rosehill or rosella (*Platycœcus eximius*) rise up or flit across the road, uttering their shrill cries of annoyance at being disturbed. A few cockatoos screech as if they were paid politicians. At length we suddenly deflect from the road, and make one for ourselves on the hard white sands of Portland Bay. Portland is in sight on the other side, separated from us by a wall of sea-rock, part of a ridge of lava which anciently flowed from Mount Eccles. The coachman cheerfully entertained me by speaking of the hair-breadth escapes he has had in the very quicksands we were driving over.

But at length we rattle into the well-kept streets of Portland town. The houses everywhere show it is an anciently-settled place, and to my mind there was an undefined English look about it. For the first time in Australia I found our English daisies and dandelion almost as common in the pastures and on the strips of roadside green as they are at home.

Looking at the town from Prospect, my host's house, across the estuary to the green hills on which Portland is built, was a very pleasant sight, and fully warrants the name given to the mansion. I was still more struck, next day, by the picturesqueness of Portland Bay. The sea was of a turquoise colour, and the few fishing-boats and ships rendered it very attractive. I am told that Portland is becoming a seaside resort. It ought to be for those to whom quiet peacefulness and charming scenery are desirable.

The Portland people had set their heads on finding coal, and they apparently did not think much of any geologist who could not tell them where it was.

What Portland really wants to make its fine and attractive bay commercially beneficial to the town are plenty of strong arms to cut down the dense gum-tree forests which invade it on the landward side. Sun and air would then get to the ground, now uselessly littered with bark flakes and dead leaves, and grass would spring up and feed cattle and sheep.

I have said that the very neighbourhood is full of interest to a sightseer. Just outside the town the heath was one carpet of flowers. To breathe the air is like drinking old wine; there is an exhilarating effect about it. Then, within the space of a few miles' drive, we have some of the finest sea-scapes in Australia, as at Point Danger, Cape Nelson, and Cape Bridgewater. The bold coast-line possesses an extreme interest for a geologist. In places the cliffs are built up of black, red, and grey volcanic rocks; in others they are composed of blown sand. In the lovely Bridgewater Bay the cliffs are hung with creepers, scarlet peas, clematis, and many another seaside vegetable frequenter, whilst the rounded and high sand-hills are greened over with grasses. Blown sand appears to have been accumulating on this part of the coast for ages past—perhaps throughout the Pliocene and Pleistocene periods, for we find it compacted into a calcareous sandstone, quite hard; and in some places, as at Batt's Ridges, caves occur in it. In Portland Bay this bed contains numbers of the light tests of fossil echini, but all appear to have been blown up from the sea, just as we may now observe the modern shells blown inland a mile away from Bridgewater Bay.

The "Blow Holes" near Cape Bridgewater are a splendid sight. The Antarctic Ocean breaks against land here for the first time. The cliffs are almost perpendicular, and are composed of dark-coloured volcanic rocks, capped by hardened blown sand. The sea waves break up into white surf, which rises and curls like smoke, and the noise of battle goes on night and day.

Close by is a singular phenomenon, locally known as the Petrified Forest. A number of concretions have been formed in the æolian deposit, and these weather out in concentric rings, simulating all the appearance of woody structure, even to the bark. I never before saw anything more remarkable. But the "trees" are crowded too closely together to have ever been real trees, for even some of the largest are not more than two inches asunder. A careful examination of the ground shows the process in every stage of development by which the concretionary nodules are weathered out, so as to produce this remarkable appearance of a "Petrified Forest."

CHAPTER XIV.

OVERLAND.

THE overland journey from Melbourne to Sydney is well known to the inhabitants of both those great cities. But they could hardly afford a stranger a better idea of the vastness and possibilities of the great Australian continent than by taking him over this route, between five and six hundred miles in length. In the colony of Victoria it passes through thriving and increasingly-populated towns, over rich green plains, peopled with flocks and herds—all of which are significant of the energy which has converted the wilderness into a garden, and made the desert to smile. If he possesses a geological eye, the traveller sees abundant evidences of volcanic disturbances and ejections long after he leaves Melbourne; but these rocks, rich in mineral matter, have weathered into soils which the skill and industry of man have compelled to produce the pastures they have sown over them, the crops they cultivate, and the gardens and vineyards they have planted.

In the more undulated districts the Silurian rocks crop up as soft, easily-weathered shales, which may be seen in the railway-cuttings resting at all possible angles of disturbance—sometimes in one direction and sometimes in another. Occasionally they are nearly vertical, and frequently they are crushed and contorted. But none of these disturbances are connected with the volcanic outbreaks of which we have so much ocular evidence—notwithstanding that the Silurian rocks may be seen occasionally capped and overlaid by the "bluestone," as it is popularly called. The Silurian strata received all of these dislocations and alterations perhaps millions of years before the volcanoes of Victoria commenced their existence.

As we near the New South Wales border, some beautiful bits of landscape scenery put in their appearance, for the spurs of the Australian Alps extend as far as Euroa, and their forest-clad slopes and precipitous sides, the dark gullies and green valleys, suggested rich harvest-fields for the naturalist and the geologist, and congenial pedestrianising grounds for city men out for a holiday. One of my great misfortunes was that I had not time to visit the Australian Alps—the Switzerland of Victoria.

We cross the Murray at Albury, for this river forms the boundary between the two colonies of Victoria and New South Wales. Even here the Murray is a majestic river, and it was flowing with a quiet but steady and dignified roll, as if it were conscious of being the longest and most important river in all Australia. This is one of the finest wine-growing districts in Australia, and in many places the aspect of the country is quite continental from the large area of the vineyards. All this time the only rocks visible in the railway-cutting are those belonging to the Silurian formation. So it continues until we nearly reach Gundagai, and then we pass over the solid granite—which fact indicates that many thousands of feet of overlying rocks have been stripped off before the once underlying granite was laid bare to the light of day.

Just before we reach Yass a patch of Devonian strata is cut through—a mere outlier, a small fragment of a former extension of this important formation, all of which has disappeared except this and a few other patches farther south, which tell of the vast denudations which must have gone on in bygone ages. Yass is a deeply-interesting place for a geologist to stop for a few days. There is another outcrop of granite in the neighbourhood, and in the opposite directions the Devonian strata occur, together with bands of limestone and Silurian shales rich in beautifully-preserved *trilobites* and other fossils.

Gradually we ascend to the city of Goulburn, more than 2,000 feet above the sea. It is a picturesque and clean town, with wide streets and fine buildings, surrounded by a breezy open country on one side, and a bold, craggy ridge, half forest-clad, on the other. Goulburn is said to be so healthy that the doctors rely on the natural increase of population for a living! South of the city we can see where sheets of lava or diorite have burst through the Silurian shales, and we can trace the flow of the lava-sheets by the streams of rough stones which cover the slopes. The outline of the country, therefore, must have been denuded into pretty much the same outlines it now possesses before the volcanic energy manifested itself.

On the other side the city, the boss of white, bald metamorphosed limestone forms quite a prominent feature in the landscape. Both red and green porphyry, very beautiful in colour and texture, occur in the same range of hills.

A sluggish river—evidently much diminished from what it must have been in the Pleistocene period ot Australian geology, when the rainfall was much greater than it is now—finds its way between the railway and the hills, and the railway crosses it by a magnificent viaduct a short distance from the city. Even now, in the rainy season, this sluggish river is converted into a raging torrent like its ancestor. Sheets of "drift," cut through by the existing river, testify to the much greater river-wash and waste of former times. The entire broad valley is underlaid by it, and we observe beds of similar drift in the railway-cuttings between Goulburn and Merulan.

Dead and dying forests of gum-trèes are prominent objects up to Bunadoon, where, at a height of 2,200 feet above the sea-level, there are abundant proofs of comparatively recent volcanic activity, in the shape of volcanic agglomerates, plainly visible in the railway-cuttings. The latter are always useful indices to the geologist of the nature of the country he is travelling through.

From the railway we see in the monotonous and half-cleared gum-forests conical heaps of yellowish earth. Some of them are four or five feet high, and many of them stand alone. Others are visible in the interior and at the base of hollow and dead gum-trees. They are ants' nests. The former were originally constructed within the hollow trees, and so durable are they that these heaps of earth have remained behind long after the trees have completely decayed. As soon as a tree grows hollow (which it does by the decomposition of the pith or central part) ants appear to get in and fill the hollow part up with clay and earth. The expansion of these substances by absorbing moisture when heavy rains succeed a period of drought, may so throttle and inconvenience the trees as to produce that apparently mysterious dying without any cause on the part of the gum-trees which has recently been the subject of scientific discussion. Anyhow, there is evidently a distinct relationship between the hollow gum-trees and these large ants' nests hereabouts.

Mittagong is a well-known and much-frequented place for tourists and visitors in the summer time, when its height above the sea makes life not only endurable, but highly enjoyable. Geologically, the country is formed of the Hawkesbury sandstones—so well known in the vicinity of Sydney, and out of which the fine buildings in the latter city have been chiefly constructed. The "Gibraltar Tunnel" is cut through them. They run right on to the Blue Mountains, which are composed of them. Over a large area they are covered up by a later formation of soft, yellowish-grey shales, called the "Wianamatta Series." Between Mittagong and Picton one gets repeated glimpses of magnificent scenery on every hand, but especially on the north. The view is remarkable, even in Australia, for the sense of vastness it conveys to the mind. The cobalt blue of hills beyond hills appears in different shades, and the vast primæval forests the train rattles through form an appropriate foreground. On either side the railway there is an abundance of characteristic Australian vegetation—masses of the dwarf Banksia, or "bottle-brush tree," various species of acacia, or "wattle," now all in exuberant blossom, from pale primrose colour to a brilliant yellow. Woods of "she-oak" (*Casuarina*) are interpolated, and there is an abundant undergrowth of the Isopogon, or "buck's-horn," as well as of "grass-trees" (*Xanthorrhea*). The tall flowering spikes of the latter are very prominent objects in an otherwise somewhat monotonous, although impressive, vegetation.

Between Mittagong and Picton the difference in the levels to which the railway ascends from the latter place is 1,500 ft., although the distance is short of twenty-five miles. Even from the railway we can see the gleaming surfaces of lakes, set in a dense framework of hills and forests. Then we flank and cross a branch of the Nepean, the river Georges, margined with exuberant vegetation, and pass through miles of uncleared forest, already marked out into "lots," although at present the dead and dying gum-trees have a dense undergrowth of "bush," composed of wattles, buck's-horn, and *Epacris* of many species. The latter are nearly all in flower, and in places the ground is a carpet of pink and crimson, flecked with yellow and white.

And so we pass on, through the comparatively ancient and quaint town of Liverpool, where the woollen-mills and other buildings appear antique when compared with the overpowering rawness of the newer towns of many parts of Australia. At length we feel we are approaching a great city, for it is foretold by the penumbra of suburbs. So we steam and whistle ourselves into Sydney station, and alight to find ourselves confronted with the ugliest monster which civilisation has evolved—the motor-engine attached to a Sydney tramcar.

CHAPTER XV.

NEW SOUTH WALES: SYDNEY.

THE first thing a man does on arriving at his destination by train is to go to his hotel. Sydney was not well off in the matter of hotels when I was there. One or two new ones were being built, I was told, and everybody I spoke to agreed they were much wanted. I stayed at one of the principal hostelries, where the most remarkable feature was a menagerie of cockatoos and parrots, kept for the delectation of the landlord and the torment of the deluded guests. These garrulous birds were screeching and shouting and laughing from early morn to dewy eve, and the careful and courteous attention of all the waiters in the establishment hardly atoned for it.

But of Sydney city too much can hardly be said. It reminded me of Bristol and Liverpool rolled into one, with a dash of Edinburgh about it. The beautifully-coloured sandstones have given Sydney an advantage over Melbourne in the architectural character of its public buildings. Those of the latter city are built chiefly of lava, or "bluestone," which, however endurable, has a dull and sombre appearance. It may tend to give dignity and heavy respectability to some styles of architecture, but it can never bestow beauty. However, cities, like individuals, are frequently left without choice in such matters, although people sometimes speak as if accidents of this kind were the reward of virtue. Thus, I heard not a few people in Victoria speak of its climate as though it were a product of home manufacture; and many Sydney people talk of "our harbour" as if it had been created at the direction of the town council.

But the beautiful stone which abounds in and under Sydney, and which was formed and upheaved ages before the appearance of man upon the earth, has had much to do with the general attractive look of the city. It varies in the most remarkable manner, from shades of the tenderest pink to primrose, yellow, grey, and even red. It is also fairly—in some instances, capitally—durable. The absence of smoke in the atmosphere, and the general dryness, combine to preserve the colour of the stone. In London, the same materials would assume the metropolitan sootiness in a year or two—in Sydney the stonework of the buildings only mellows, not spoils.

There is a bit of old Sydney just behind the hotel where I stayed, and running right down to the water's edge, which is disappearing like snow in spring. Next year, I believe, Sydney will celebrate the centenary of its incorporation. It is a proud event for New South Wales. But I should like to see some permanent photographs or etchings of the old houses, which are disappearing so fast because the ground on which they stand is so valuable. Sometime or another in the future, when Australian history is advancing, people will be sorry that the "primordial cell" of this great city was destroyed before due artistic notice of it was taken. They are very picturesque, these old Sydney houses, going back, as they do, to the ancient days. They are generally single-storied, but there is a range of solid stone steps leading up to the doors, for stone was cheap and easily procured. Every step is worn hollow by the tread of myriads of steppers, by far the greater part of whom "have crossed the flood." The windows are old-fashioned and English-looking; the roofs (covered with wooden shingles instead of slate, or instead of the still more prosaic and unpicturesque corrugated galvanised iron) are greened over with the spores of moss and lichen. You might fancy yourself, as I often did, in some of the outlying parts of a Yorkshire or Lancashire town, where the houses are chiefly built of stone, so English-like are the houses and their architecture. They have been worn and weathered in pretty much the same way, and when I wandered down by the water-side, and looked on all these things, I could hardly realise that I was close upon 14,000 miles from home.

It would be a wise and a good thing to artistically immortalise the ancient nucleus of Sydney, as represented by these houses and buildings, before it is too late. The old must necessarily give place to the new, but there is no reason why the former should not administer to the artistic pleasure of the latter. They are not unpicturesque, these ancient Sydney domestic relics. Etching, perhaps, would do them the best artistic justice. In a century hence hundreds of thousands of people will be glad to avail themselves of the early history of the first

Australian colony. Meantime, they are passing away unobserved, and their places will be taken by grander buildings unpossessed of a tithe of the historical importance of the insignificant huts they have replaced.

Sydney has an advantage over all other Australian cities and towns in that it possesses an ancient history. Already it affords work for an antiquarian society. The old is fast giving way to the new, but there is sufficient of the original settlement left to surprise an English visitor with the striking resemblance to similar domestic buildings in any old town at home.

Then, again, the names of the streets. There is a good deal of contemporary history in the street nomenclature of our increasing towns in Great Britain. "Balaclava" street and "Redan" street are repeated again and again in each, and everybody knows these names were given to the new streets built during the Crimean War. We have also numerous "Metz" and "Sedan" streets, "Cyprus" terraces and villas, "Ashantee" places, &c., all of which equally indicate the leading events of the time when these streets and houses were erected.

I was strongly reminded of this fact when in Sydney. The old streets bear the distinguished names of the individuals who lived "when George the Third was king." Thus the principal ones are named "George," "Pitt," "York," "King," "Liverpool," "Bathurst," "Clarence," "Kent," and "Sussex" streets, and they immortalise the names of the King, his sons, and Ministers, whilst "Macquarie" place and street, and "Elizabeth" street, proclaim how popular this Governor and his wife were in the colony of New South Wales; and "Phillip" street, "Bligh" street, "Castlereagh" street, "Goulburn" street, &c., are all of them historical in enshrining the names of Governors and other eminent individuals who were connected with this ancient settlement.

When I arrived in Sydney a period of long drought had been followed by a compensating downfall of eight inches of rain in about twenty-four hours. The latter was the period selected for welcoming the Soudan contingent back, and it must have been a rich treat for soldiers who had for months been suffering desert thirst. Even during the first week I was there, one day there fell two inches of rain between four and six o'clock in the afternoon. The days between these rainfalls were marked by a most heavenly climate. A sky more delightful than that of the Mediterranean was overhead, out of which the sun shone cheerfully, and stimulated one's animal spirits to a high degree. A little after noon, although it was early in July (corresponding in climate to our English January), it was as warm, sometimes as hot, as it is in London in July or August.

There are many objects to delight a naturalist stranger in Sydney and the neighbourhood. Some interesting geologising is to be done in the sandstone quarries and outcrops, shell-collecting on the sands of such easily-accessible places as Botany Bay, capital dredging in any of the arms of the lovely harbour, and excellent botanising in the hilly grounds round and about the latter.

The dredging in the harbour is all the more interesting because of the still-surviving ancient forms of life we find there. Professor Moseley, in his "Notes of a Naturalist," says:—"Whilst we were at Sydney, the ship's steam-pinnace was constantly employed in dredging for Trigonia shells in Port Jackson. These shells, in shape very like cockles, are immediately known by their brilliant pearly lustre within, and curious complicated hinges. They vary very much in the tint of the nacre inside. Some are orange-tinted, others pink or purple, some without colour. The shells are worn very much by the ladies of Sydney, as earrings and other ornaments, set in gold.

The shell is especially interesting to the naturalist, because it occurs as fossils in Secondary deposits in Europe, and was long supposed to be entirely a thing of the past, until discovered living in Sydney harbour. Moreover, with it is found a most remarkable fish, the Port Jackson Shark (*Cestracion Philippi*), which is also closely allied to fish remains which are met with in the deposits together with the Trigonias."

Sydney is fortunate in numbering well-known scientific men, such as Ramsay, Wilkinson, Macleay, Tenison-Woods, Dr. Woolls, Dr. Cox, Fitzgerald, Stephens, and others among her cultivated classes. Many of these names are as well (perhaps better) known in England as in Australia. The Linnæan Society of New South Wales has been in existence ten years, and its "Proceedings" contain valuable original papers relating to the geology, zoology, and botany of that colony.

The Botanical Gardens are easily reached by the well-kept Domain-road. These roads are bordered by rows of the cheerful and neat Moreton Bay fig (*Ficus longifolia*)—an admirably-adapted tree for all Australian towns, but which I had never before seen in such a robust and flourishing condition as hereabouts. Speaking of this tree reminds me of some singular observations which have been recently made on the manner in which the well-known flowers of this tree are cross-fertilised. They were communicated to me by Mr. Whitelegge, an assistant in the Sydney Museum—a man whom I had known in the old country as one of the ardent and enthusiastic Lancashire naturalists. The flowers of figs are arranged in just the opposite manner to those on the head of the daisy. In the latter we have about one hundred little yellow florets forming the disc. All are open to the air and the insects, except when the white ray-petals fold over them. But in the fig the flowers are inside, male and female, and there is only a small hole which communicates with them from the outside. Mr. Whitelegge finds that these clustered interior flowers are fertilised by a species of minute insect belonging to the wasp and bee family (*Hymenoptera*), in which the males are wingless and the females are winged. These insects enter the hole from the outside to deposit their eggs, after the manner of the gall-producing species belonging to the same order. The pollen secreted by the ripe flower is, of course, shed over these insects when they enter for the above purpose. But if the flowers are not quite ripe and ready, there is actually a means provided by which the insects are kept prisoners within the hollow colony until they are. These insects are meantime provided with board and lodging gratis. Then when the male flowers ripen and discharge their pollen upon the insect prisoners, the latter are liberated. They make their way to some other fig-flowers, and all unconscious that their bodies are merely the vehicles or carriers of pollen-dust, they thus cross-fertilise the Moreton Bay fig. Whenever the flowers of this well-known tree fail in securing this ingenious bit of insect help, they wither and fall off, so that the hundreds and thousands of round balls dropped from them, and which sometimes strew the ground beneath, are so many "failures."

The Fine Art Gallery is near the entrance to the Botanical Gardens, but I am not required to say more about it in my character as naturalist than that there is an admirably-selected series of oil-paintings, water-colours, engravings, and etchings, as well as a few well-chosen sculptures and modellings. This I say notwithstanding the *replica* of the "Roll Call" affair. The Sydney Art Gallery has wisely elected to possess a few good things rather than a number of inferior or indifferent ones.

The Sydney Botanical Gardens soon get hold of a stranger—their site is so admirably chosen. There is nothing in all the wide world like it, and it is so near and so easily accessible to this great city. The Gardens skirt the water's edge, and as we walk along their shoreward end we see crowds of oysters clinging to the sea-wall in the clear water on the one hand, and palms, bananas, tree-ferns, &c., growing in the Gardens on the other.

What struck me most was the well-kept and *green* condition of these public grounds, for they are much frequented, especially on Sunday afternoons. I went there one Sabbath day, and was pleased to see them crowded, and that by people of the right class—clerks, artisans, and labourers, with their wives and children, all well dressed, and looking well fed. I should think four or five thousand people were present, walking, sitting, or reclining on the grass. But everything was as orderly as the interior of a cathedral.

But the Gardens were not only fortunate in early possessing one of the most picturesque sites and situations of the many for which Sydney Harbour is famous—they were still more so in having appointed as their director, nearly forty years ago, a man so energetic, both as a botanist and horticulturist, as Mr. Charles Moore, F.L.S. He has devoted an active and ardent life to the development of these noble grounds; so that few civilians have left their mark more plainly upon the outdoor enjoyment of Sydney life than he. In these Gardens, both botanists and horticulturists are catered for, as well as the many-headed public to whom botany is a delusion and horticulture too often a snare.

The Gardens have, like those at Melbourne, patches devoted to the illustration of the natural orders, although they are not so well or fully represented as at the latter place. There are many trees of special note growing in the grounds, the principal of which, perhaps, is a magnificent Norfolk Island pine (*Araucaria excelsa*)—a tree very abundant in the larger gardens and shrubberies of nearly all Australian towns. There are also fine specimens of the well-known Australian proteaceous plant, *Grevillea robusta* —perhaps the largest and most attractive of this singular order. *Merytas*, with their broad and showy foliage, the maidenhair-leaved *Salisburia* from Japan (a coniferous tree, which has been in existence ever since the Carboniferous period), the singular Mauritian palm, the bloodwood of Norfolk Island (*Baloghia lucida*), the osage-orange of America (*Maclura auriantiaca*), the Moreton Bay chestnut (*Castanospermum Australis*), with its deep-green foliage and bright scarlet flowers, the tulipwood of Eastern Australia (*Harpallia pendula*), the *Randia macrophylla* from Lord Howe Island, besides bananas, bamboos, multitudes of species of palms, New Zealand cabbage-trees, Dombyas, Pterospermas, Nepheliums from China, Eleocarpus from India, Brexias from Madagascar, Lactarias from the Queensland bush, sacred and other fig-trees from India, Sciadophyllums from New Guinea, Botryodendron from Norfolk Island, Cycads and Zamias, Strelitzias from the Cape, a vast number of species of pines, Erythrinas from the West Indies (just bursting into their singular scarlet blossom), and many others too numerous, but not too unimportant to mention unless in a botanical inventory, make up the diversified and wonderfully combined arboreal foliage with which the variegated surfaces of these beautiful Gardens are clothed.

Floral parterres and patches are gay with flowers, whose manifold colours offer a rich feast to the eye. The rocks and rocky places are covered with the grotesque forms of cactuses and aloes. Climbing plants from all parts of the world have been trained to clamber up and festoon trees and shrubs of a less conspicuous character. All that botanical and horticultural art and skill can do, combined with, perhaps, the most picturesque situation in the world and a delightful climate, have made the Sydney Gardens a place worth coming to the Antipodes to see.

The Sydney Museum is a noble building, formed of the beautiful sandstone of the district. It is capacious, well lighted, and remarkable for its cleanliness and order. All the collections are well and distinctly named, as one would expect from knowing that the curator is Mr. E. P. Ramsay, F.L.S. Perhaps nowhere in Australia is there anything approaching the magnificent collection of Australian marsupial mammalia here exhibited, and the specimens are so well preserved, and most of them mounted in such picturesque attitudes, that there is none of the formal stiffness we usually see in museum collections. Many of these marsupials are now very rare, and in a few years many more will be completely extinct. It is, therefore, a fortunate thing for Australian naturalists that such a good collection as this has been made in time. The marsupials already extinct are represented by the fossil remains of the *Diprotodon*—a gigantic fossil wombat, the marsupial lion (*Thylacoleo carnifex*), and of *Nototherium.* The skeletons of different animals, from the Australian sperm whale to those of local fishes, are all well prepared and mounted. It is seldom one sees such a capital collection of fish and bird skeletons as is here on view. Another numerously-represented series is that of the Australian rats and bats. Prominence has in every case been given to Australian animals—insects of all classes, birds, reptiles (especially the lizards and snakes), amphibians, fishes, and mammals. Australian conchology and zoophytology (both abundantly rich in selected specimens) occupy considerable space. The geological and mineralogical collections are in a separate room, which appeared to me to be too small for them. The specimens are largely Australian, and their localities are all mentioned—a boon to the student which curators do not always remember. But the general palæontological collection contains typical and characteristic fossils from all parts of the world, or casts of them.

Although the Royal and Linnæan Societies are doing good work in physical and natural science, it seemed to me that the public of New South Wales had not yet been inoculated with a love of it to the extent the Victorians have. Sydney is a vast and populous city, and it would be a good thing to remember that knowledge knows no monopoly, and that whatever we may think of protection elsewhere, in science there must be free trade.

One of the commonest trees in the neighbourhood of Sydney is the *Araucaria Cunninghami*, or Moreton Bay pine. It is not nearly so elegant a tree as the Chilian pine (*Araucaria excelsa*), but it has a singular interest to botanical geologists; for both this tree and the Australian native pine (*Frenela* or *Callitris*) grew in England during the Eocene period. Mr. Starkie Gardner describes both in his monograph of the Eocene flora. I have before alluded to the significant relationship between the existing Australian flora and that of the Northern hemisphere during early Tertiary times; and I was frequently reminded of the similarity when rambling in the "Bush" near the sea, where the flora remains undisturbed. Mr. Starkie Gardner makes special allusion to the Australian flora, which seems to assume more of an Eocene appearance as we approach Queensland, as follows:—"The existing *Araucaria Cunninghami* forms vast forests on the shores of Moreton Bay, on the alluvial banks of the Brisbane River, and grows in the greatest profusion in the bush-forests of the Richmond River." He then quotes Mr. Charles Moore, who speaks of them as follows:—"The trees seem to thrive best near the coast, attaining in such a situation their greatest height, often from 100 to 130 feet, but gradually diminishing in height the farther the trees are inland. It would appear from this that the sea air has a great effect on them." These bush-forests are thus described by Moore:—"The bush is characterised by denseness of growth, the altitude and beautiful dark-green foliage of the trees, the presence of lofty climbing plants, which extend their slender, pliant branches considerable distances, and by this means often embrace, as it were, into one common bond many of the loftiest and largest trees . . . . . Another characteristic of forests of this description is a thick undergrowth of numerous kinds of fern and other plants. Palms and tree-ferns also usually abound, the former reaching a height in some instances of at least 130 feet. . . . . On the stems and branches of the trees numerous kinds of epiphytal ferns and orchids grow, which, with the other plants referred to, contribute materially to give such forests a very tropical appearance." Afterwards Mr. Gardner remarks :—" It is clear from the association together of the *débris* of trailing Smilaceæ and Aroids, and from the remains of large fan-palms and ferns, that our English Eocene bush-growth must have been very similar to that described by Moore. The physical aspect of the former station of araucaria on the alluvial banks of Great Bournemouth River, and its probable extension along the east coast of the submerged continent, must have approximated to those it now occupies on the Brisbane River and the shores of Moreton Bay, on the east coast of Australia. Nothing can be more impressive, indeed, than the remarkable agreement in habit between the araucaria and associated plants that have passed away and those that survive so far away. The long-embedded plants of our Eocene coasts seem to have risen up and to live again in a distant country, and through what exists there we are able to picture the long, sandy coasts, beaten by an ocean surf, and fringed with dark-foliaged and gigantic araucarias, gum-trees, luxuriant palms and ferns, whose remains have helped to form the cliffs and moors of pine-clad Bournemouth. If we contrast this with the comparative absence of any similar associated vegetation in the Mammoth Grove, we see how opposed would have been the contemplated reference of these branches to Sequoia under any known natural grouping."

CHAPTER XVI.

THE ENVIRONS OF SYDNEY.

THE Sydney people are good-naturedly twitted by other Australians about "our harbour." I was told both in England and the colonies that when I got to Sydney this would be the first question asked me, and that I must be sure to say I admired the harbour very much. I had heard many people speak of the scenery, but no idea had been conveyed to my own mind of its surpassing loveliness.

For the first two days after my arrival in Sydney we enjoyed heavenly weather; and, as this came after much rain, both earth and sky seemed clear and cheerful. There was a pearly lustre about the sky I had never observed before, although I noticed it in every subsequent sunny day. A summer-like haze hung over the land and sea-scapes, although it was early in July—corresponding to our English January. Towards noon this haze grew too thick; but in the earlier part of the day it added considerable beauty to the scenery, by suggesting attractions beyond those the eye had already taken in.

Every day that was fine, when I could possibly spare the time, I devoted to exploring the picturesque beauties of some part or another of Sydney harbour. The place grew upon me, and had a greater charm for me the day I left than even on that first day of my arrival, when I sailed up Lane Cove River, and admitted that if anybody had a right to be proud of the scenery in their own neighbourhood it was the Sydney people. The rocks are the geologically famous "Hawkesbury sandstones," in which occur beds of the massive freestone I have already alluded to. The strata are intersected by extensive joint-planes, which cut them through as clean as if by a saw. These fissures tend to cause the rocks to weather or waste in cubic masses, leaving the promontories of the land, which extend to the water (or "Heads," as they are locally termed) with almost perpendicular faces. We see this feature repeated again and again, from the great "South Heads," some miles down from Sydney city—the great gates through which vessels enter from the Pacific Ocean inside—to the smallest point of the numerous promontories which jut out from the mainland.

One hardly knows whether to speak of the many-fingered land spreading itself out into the water, or of the sea sending forth its many arms far up into the land. In reality, the latter is the geographical state of the case; for, standing on the summit of one of the South Heads, where the Pacific tide enters, we see the "arms" extending as "bays," "creeks," and "rivers," as they are called, often irrespective of their geographical correctness, but solely to save verbal repetition where such a number of similar scenic features have to be named and identified. Among the principal of these are Parramatta River, which extends farthest up into the mainland, Lane Cove

River, Manly Bay, Watson's Bay, Mossman's Bay, Pearl Bay, Long Bay, Sailors' Bay, Chowder's Bay, Neutral Bay, Vaucluse Bay, Double Bay, Rose Bay, coves and creeks innumerable, besides North Harbour, South Harbour, Middle Harbour, Darling Harbour, &c. I was told—but I cannot vouch for the correctness of my information—that all this ramification of harbours, bays, creeks, coves, &c., represents an actual shore-line of hundreds of miles.

When the sun shines on the bold bluffs of the heads, or on the almost precipitous surfaces which the joints of the strata expose to the weather, the yellow warmth of the stone forms a beautiful contrast to the dense growth of trees and bush which crowns and covers the rounded and flowing outlines of the hills above. The colour of the vegetation is sombre and monotonous, after the manner of that of gum-trees generally, but the ground beneath is a carpet of brilliant scarlet, pink, purple, yellow, and white, from the abundant growth of epacrids and other characteristic Australian wild flowers.

The water in all these bays, creeks, &c., has, as yet, hardly been polluted by man, and it is of a Mediterranean blueness. Every arm is deep enough for large ships to come almost alongside the shores, plainly showing how the steep heads and walls of rock above water-mark are continued downwards for some distance below it. If we could drain all this water away from the bays and creeks of Port Jackson—or, better still, if we could tilt or bump up this part of Australia a couple of thousand feet—what a magnificent series of valleys with precipitous and wall-like sides we should have! There would be nothing like it in all Australia, except the anomalous hollows and valleys possessing precipitous sides which we find in the Blue Mountains.

That is just the point, and it affords us a clue to the geological and geographical origin of Sydney Harbour. The rocky materials which form the Sydney Heads—and, indeed, all the area on which the city stands—are of the same geological age and origin as those which build up the Blue Mountains. These rocks have a wonderful history, geological and otherwise, and just now they are the subject of ardent scientific controversy. The Rev. J. Tenison-Woods regards them as of Æolian origin, that is, he has written a very able paper on the proceedings of the Linnæan Society of New South Wales, to prove that all these rocks, extending from Sydney to the Blue Mountains—about 150 miles long by about 100 broad at the least—were formed out of *blown sand*, just as the sand-hills near and at Coogee Bay are. Moreover, this wind-blown sand must have required hundreds of thousands, if not millions, of years, not only for the materials to have been supplied from older rocks by ordinary weather waste, but also for the materials to have been gathered and piled up together. He points to the peculiar dip or inclination of the stratification as a partial proof of his bold hypothesis. This is of the kind known to geologists by the name of "current-bedded." It is always on a very local—nay, a very limited—scale. "Current-bedded" strata unquestionably do occur in many rocks, but only in those which have been deposited in shallow water, where the changing tidal and other currents lay down the sand in a different direction to-day than they did perhaps a year ago.

But Mr. Tenison-Woods says:—"No. This so-called 'false bedding' in the Hawkesbury sandstone is not a sign that they were deposited in shallow and moving water, in this instance; but it represents the 'angle of rest'—that is, the slope at which sand will stop running down, say, on a newly-formed railway embankment when it is tilted, or on a seaside sand-hill when it is blown. Here and there, in these sandstones, one may see lenticular or 'lens-shaped' bits of shale, some of them almost approaching the character of true coal. These," says Mr. Tenison-Woods, "merely represent the little hollows on the ancient and extensive sand-dunes, where perhaps the accumulation of water allowed vegetation to grow."

Then, again, we get in these sandstones, here and there, black blotches and specks which sufficiently proclaim to the trained geological eye that they are of vegetable origin. We break a piece of the rock away, and find embedded in it the fronds of fossil ferns. That is no new thing to the geologist. I have found them in England and Scotland as beautifully preserved as if they had been purposely laid out in a herbarium. But in every instance I have seen, the vegetable matter of the fossil ferns has been converted into a pellicle or film of true coal, nevertheless retaining the most delicate outlines of the veins, &c., thus showing how slow and sure has been the process of carbonisation.

But the fossil ferns found in many parts of the Hawkesbury sandstones differ entirely from all others in their mineralogical character. They are carbonised, it is true; but they are not converted into *coal.* They show every vein and other part of fern structure; but they are quite brown, and as *flexible* as if they were so many films of gutta-percha. Mr. Tenison-Woods says this is due to the odds and ends of ferns and other vegetation having been so thoroughly dried in the hot sands which accumulated during hundreds, if not thousands, of centuries, and thus preserved its vegetation in quite a different manner to that with which it would have been kept had these arenaceous materials been deposited in the ordinary manner—namely, as sediments under water.

My readers will see how much real and genuine scientific importance may be attached to a chip or a splinter of the yellow sandstone so abundantly used in the new buildings of Sydney.

The microscope is now almost as much employed in geological investigation as in zoological or botanical. Dr. Sorby set us the example, and some of the most "brilliant and trustworthy discoveries in the 'stony science'" within the last few years have been made by this valuable instrument. If we subject a bit of this yellow sandstone to microscopical examination, using only a *low* power, we see that it is entirely made up or composed of small grains of *quartz.* These are as genuine bits of quartz as if each weighed one hundred tons. In fact, the grains of quartz are nothing more nor less than the bits of weathered quartz chipped off some ancient and exposed "reefs" by the action of the weather of millions of years ago.

But in our piece of Sydney sandstone we plainly perceive that each grain of quartz looks as if it were *water-worn*—that is to say, all the corners and angles have been rubbed down by some kind of friction or another. What was the nature of this friction? Hitherto geologists have always regarded it as due to the attrition of moving particles of quartz among each other in *water*. In nineteen cases out of twenty I have no doubt this explanation is the correct one; but Mr. Tenison-Woods holds that the *very rounded* condition of the quartz grains which compose the Hawkesbury sandstones is in favour of his theory of the original wind-blown origin of all these vast strata, averaging nearly a thousand feet in thickness, inasmuch as wind-blown sand always has the separate quartz grains more thoroughly rounded, through being so easily moved over and among each other, than is the case with shallow-water moved grains.

There are not a few difficulties in the way of Mr. Tenison-Woods' theory, but it is a novel one, and it is ably set forth in the paper above mentioned. Geology is one of the most conservative and yet one of the most radical of sciences. It sticks by the "old paths" as long as it can, and fights the "new views" to the bitter end, but the conflict usually terminates by accepting—in whole or in part—the latter. No geologist doubts that there are such deposits as Æolian, or "wind-blown," at the present day. The vast areas of moving sand in Africa and Asia would support such an idea, even if the sand-dunes margining the coast-lines of the world, where the land and sea breezes fight for the mastery, did not prove it. Then, if these agencies are at work to-day, piling up and heaping together the worn-off particles of older rocks, why should they not have been equally in operation during the periods of the past? and, if so, why should we not have geological relics of such Æolian deposits other than the last and most recent?

For myself, I hold that this theory of Mr. Tenison-Woods, whether ultimately proved in the magnificent example he adduces or not, is a gain to speculative science. I have long thought that Solar denudation has not been sufficiently taken into effect in Physical Geology. Twenty years ago, it was the fashion to give the sea the predominance as a denuding agent. That was in the geologically conservative times. We laughed when poor old Colonel Greenwood published his quaint book entitled "Rain and Rivers," wherein he showed that it was the earth's atmosphere, and not the sea, which did all the wearing-and-tearing work. But geologists don't think so now—and Colonel Greenwood is dead!

You travel in the deserts—African, Asian, or American—where there is a minimum of rainfall (or none at all) and a maximum of sun-heat, and you ask yourself what must take place? The sun's heat, falling upon any rock-surface, expands the particles composing the stratum, loosens them, and they fall down and accumulate as "dust." There is no rain to wash them away—only the wind to blow them away. And so the particles are rolled, and double rolled, and then rolled again. When we examine them under the microscope, behold what a story of wear-and-tear does each grain narrate. A human life hardly bears more knocking about, and, perhaps, a human life may claim as much of immortality as a quartz grain.

Meantime, the scientific grain of knowledge is being threshed, and the threshers are good and conscientious men. I wish every colony had nine out of ten of its male population composed of men with such noble views and high aims and hard-working self-denial as Mr. C. Wilkinson, of the Geological Survey of New South Wales.

But he does not believe in Mr. Tenison-Woods' *Mesozoic* sand-hills. Perhaps this is a good job for Mr. Woods, who will be obliged now to refine his gold more than he otherwise would have thought it necessary.

I worked at the sandstone-beds above-mentioned, as they are cut through or revealed by artificial and natural sections in and about Wooloomooloo Bay. It is not an odorous neighbourhood; and, although the bay is very beautiful, the narrow, badly-sewaged streets leading down to it are not. But I saw the "current bedded" sandstones, with their patches of black carbonaceous matter, and got plenty of specimens of pinnules of the fossil *Thinfeldia* ferns.

The whole of that part of New South Wales from the smaller Zig-zag to the Sydney Heads, represents a "down-throw fault"—that is, a slipping-down of this part of the earth's crust. It occurred ages ago; hundreds of feet of dislocation took place, although, possibly, the displacement went on but slowly. The valleys and gorges and hollows in the previously continuous and unbroken sheet of Æolian "Hawkesbury sandstone" were thus let down to and below the sea-level. The waters of the Pacific found their way up, and filled what had previously been only land valleys—and in this way the ramified arms of Sydney Harbour originated, pretty much after the way in which we account for the numerous marine lochs off the western coast of Scotland, and the still more numerous and branching fiords off the coast of Norway.

One of the charms of Sydney, as a city of beautiful environments, is the ease with which we can get to the latter. Steamboats, trains, omnibuses, and even the ugly and obtrusive "tram-motors"—all are willing servants of the visitor, who can thus be conveyed within an hour or two from parts of the city quite English-looking and old to districts where bush-clearing and settlement are still going on.

No lovelier or more interesting trip can be made than by steamer to Parramatta, or rather to the staith where the boat is obliged to stop. We pass islands like Cockatoo Island, full of historic interest for New South Wales. We look up arms and creeks on the left-hand side, which gleam like mirrors, and are margined by thickets of acacias in full flower; we zig-zag from one side of the so-called "Parramatta River" (in reality a marine loch or fiord) to the other, stopping every mile or two at some quaint and not unpicturesque station, where the sandstone rocks rise precipitously from the massive fragments which the sea-water has greened over at their bases. Thence, rolling and slanting upwards, the broken ground is covered with bush, the chief part of which is due to the luxuriant growth of *Acacia floribunda*, whose hawthorn-like perfume fills the atmosphere. Myrtaceous plants, such as *Leptospermum* and *Melaleuca* are also abundant, and some of them are in flower. Young saplings of *Eucalyptus globulus* are plentiful, and their glaucous leaves add to the variety of the assembled foliage. The land rises in imposing masses. Cultivation and horticultural art have done much for that part of the Parramatta River nearest to Sydney, such as Hunter's Hill. There we have magnificent buildings, public and private, crowning the heights above, whilst villa after villa peeps forth from amidst the dense vegetation of the steep slopes to suggest the luxuries which abundant wealth can procure.

As we draw further away from Sydney the country is less modified by cultivation. Nature is seen there with such portions of her original garments as men have left her. I confess to preferring these gradually diminishing fragments of paradise. The lovely Australian wild flowers still blossom there; beautifully-coloured and large butterflies come to visit them, and the green parrots and parakeets bear them company.

Parramatta is exceedingly like a country town in England. The streets, shops, houses, and hotels reminded me strongly of the old home. This feeling was strengthened by a visit to the old Government House—now a boarding-school, I believe. It stands in a small park, like many such at home, and the brick and stucco Georgian house and the English oaks—which have grown to a large size since they were planted—still further strengthened the illusion, although they also demonstrated how thoroughly conservative the old settlers and colonists were, and what a tight grip on their hearts and memories everything relating to the mother country must have had.

The country on the Sydney side of Parramatta slopes more gently and undulatingly, and is covered with a thin growth of eucalyptus forest. The soil is fertile, for the underlying rocks have been atmospherically wasted for ages. It is here we have the celebrated orangeries. If the visitor lands at Ryde, and walks to the Pentland Hills, he will pass many orange-gardens. They are frequently set in a surrounding framework of lemon-trees—at least, those parts of the orangery nearest the road were; and I wondered if there were boys who lived about who were offered these sour wayside lemons to steal instead of oranges.

How bright and beautiful these orange-gardens looked. Their glossy, dark green foliage and their luxuriant growth proclaimed them to be healthy and well-cared-for trees. This was markedly the case at Mr. Burns's orangery at Pentland. For scores of acres the orange-trees extend in serried rows. Many are so abundantly laden with golden fruit they have to be supported by props. The ground beneath is strewn with the dropped fruit. We are in the Garden of the Hesperides.

The trees bear those sweetly-scented white blossoms which occupy so important a place in matrimonial arrangements, and the trees are crowded with fruit in every stage of development, from the newly-set to the fully-ripened orange. The plant was born, and bred, and educated where there are no extremes of winter cold. Its leaves are not deciduous—that is, they do not fall off at particular periods. So long as the orange-tree is planted in rich soil, is not overcrowded, is well supplied with water, and protected from cold winds and frost, it will bear blossoms and fruits in every stage of development at the same time.

This may appear somewhat strange, but it is a habit the orange-tree has acquired (through the experience of its ancestors) by living in a warm, temperate climate. I have no doubt other shrubby plants might learn to develope the same characteristics. Indeed, I was particularly struck, both in Victoria and New South Wales, with the large size to which the introduced English wild rose grows. Evidently it has found a richer soil and a more congenial climate at the antipodes. It appears to have shared in the same prosperity as its human fellow-colonists.

But the most remarkable thing about the wild roses in Australia is that they are acquiring the same trick which the ancestors of the orange learned years ago, and transmitted to their descendants—that is to say, I found them frequently bearing flowers and fruit at the same time, and this was taking place in June and July, corresponding to December and January in England. Evidently the more equable climate has affected its habits in this respect. I observed also that its foliage was not dropped—at least, not to any remarkable degree. Is the wild rose making up its mind to become an evergreen shrub, or, rather, to have descendants which shall be like the orange-tree? The degree to which plants and animals will alter their habits, and become modified in their structures, is only just being taken up by naturalists. Nowhere can this be better studied than in Australia. I hope the scientific societies of the colonies will take up the subject. Let them put on accurate record the exact degree to which the imported animals and plants vary, as well as all the conditions under which the tendency to variation occurs. It strikes me that *variation* (due to ready *adaptation*) will be found frequently to take place quicker than many geologists and naturalists have hitherto imagined. They have hypothetically formulated millions of years as necessary; but in most cases careful tabulation of observed facts will reveal to us how responsive many animal and vegetable organisms are to the conditions under which they live. Look, for instance, how quickly the European deciduous trees imported into Australia learned to adapt the time when their leaves should fall to the Australian winter. They made a muddle of it for a few years, and most of their leaves fell off during the antipodean summer; but this was because of that acquired ancestral experience we denominate *instinct*. Year by year this grew weaker in comparison with the newly-acquired *individual* experience which the new conditions of their lives revealed to them. And now they are as well adapted to Australian seasons as if they had always been Australian trees!

Let it not be supposed that I have anything to say against the mere act of drawing upon the "Bank of Time" for due explanations of natural phenomena. Time by itself can do nothing at all—although people speak of its "tooth" gnawing and eating away rocks,

&c. It is the number and intensity of the events which take place in time which makes the latter of value.

The Australian trees transplanted to India, California, and elsewhere, have had to reverse the ancestral experience handed down to them from that of their northern representatives. In the Indian botanic gardens all of their individual and infantine uncertainties in respect of the changed seasons have been duly chronicled.

Sydney and its suburbs are truly wonderful as regards the ease with which all warmth-loving forms of vegetation are induced to grow there.

For almost every Melbourne, Sydney, and Adelaide garden of any size (and, indeed, of all sizes) demonstrates this. Each is a kind of "Noah's Ark," in which we find gathered together all the "tribes, families, and tongues" of the vegetable kingdom!

What is more to the point is—such plants are doing better than they would in their original homes! Every human colonist will recognise the importance of this fact. Thus, next to the oranges, lemons, and citrons (besides varieties of each) which grow thereabouts as if it were their natural home, we have loquats, bananas, peaches, plums, and a host of other fruits native to every part of the globe. They attain a larger size there than they do in their native *habitats*—a plain proof that the old doctrine of their being found where it was best for them to grow is not correct. The loquat shrubs are especially numerous in all the gardens of the Sydney suburbs, and their fruit is extensively eaten—at which I was surprised, considering how abundant is the choice. Grenadilles (the fruit of a West Indian Passion-flower, *Passiflora quadrangularis*), also are grown, and appear on every table as dessert; but they were too much like coarse green gooseberries for me to try them more than once. Singularly enough, Australia has few native edible fruits. The native Cherry (*Exocarpus*) and Quandong (*Fusanus*) are among the principal kinds, and they are worthless in comparison with introduced fruits. There are few really frugivorous birds in Australia, or else a greater number of fruits would have been evolved. The cockatoos and parakeets destroy a deal of garden fruit now; but it is evident they have acquired a new taste and habit, the latter all the more easily, because they are fond of the honey from eucalyptus flowers.

The walks and drives in the immediate neighbourhood of Sydney Harbour were too beautiful ever to be forgotten. The ready means with which one could land at the head of some bay or creek, walk up the hill and over it down to the head of another creek on the other side, reminded me of the manner in which we can saunter from one fiord to another off the coasts of Norway. Thus I made my way from North Shore (St. Leonard's) to Mossman's Bay through thickets of bush abounding with wild flowers. Another ramble (never to be forgotten) was from Manly to Spit Point, along a magnificent, well-metalled road (made originally, I believe, by convict labour). At the latter place, after gradually ascending a country opening out like a panorama, with foregrounds reminding me strongly of the unenclosed heaths and commons at home (except that the wild flowers were more showy, and the clump of gum-trees and Banksias more foreign-looking), we catch a view of the Middle Harbour almost along its entire length. It is a lovely picture, mapped out with dark forest and beetling coast-lines, and crenulated with little creeks and bays innumerable. A thin, blue mist hangs over the mirrored surface of the water, and gives to the scene an indescribable charm.

But probably the most lovely of the many excursions one can take from Manly is that to Broken Bay. The surrounding neighbourhood has obtained more than a local reputation for the beauty and variety of its wild flowers, as the popularity of the Manly Wild Flower Show indicates. When I was there people were getting ready for the latter event, and the country was being scoured for specimens. I was informed that this annual institution had already told upon the local flora, and that many plants, formerly abundant, were now very scarce, even if they could be found at all. This is a great pity, and it reminds one of the ancient policy which killed the goose that laid the golden eggs.

Driving out from Manly along the capitally-made and well-kept road which runs to Broken Bay, and more or less skirts the coast the entire distance, we see much both to admire and study. Within a mile or two we get into the forest—and such a forest! I had not seen anything in all my Australian rambles to compare with it for number and variety of plants. The solemn monotony of the ubiquitous gum-trees has had to give way to the healthy survivals of even more remarkable types of the Australasian flora. Banksias of several species, she-oaks, or *Casuarinas*, abundance of the native pine (*Fernelea*, or *Callitris*), numerous specimens of uncommon gum-trees, native cherry-trees (*Exocarpus*), and a few solemn and stately and rare Australian palms, formed the arboreal vegetation. The ground was occupied with a bush of myrtaceous plants (*Melaleuca* chiefly), and thickets of ti-tree. In places it was quite ablaze with pink and scarlet *Epacris*, and the wild indigo plant (*Hardenbergia*) climbed and twisted its stems over and within the wiry bush vegetation, and flung its abounding spikes of brilliant purple flowers about with botanical recklessness. Here and there the tall, blackened stems of the grass-tree (*Xanthorrhea hastilis*) rose from amid the bush to the height of ten or a dozen feet, and their clusters of terminal foliage looked as if they had earned for the tree a very appropriate name.

Every now and then, through the broken ground, one caught a view of the sea-scape outside. The South Pacific was calm enough to deserve its name, although there was a long and sinuous line of white breakers, which marked where the sea lapped against the bases of the perpendicular cliffs in the seaward distance. Sometimes a low indentation brings the water into the land, and forms a miniature bay, which is margined all round by the greenest of grass, besprinkled with a few ancient gum-trees. The ground thereabouts bears relics of many a picnic, in the shape of broken bottles and numerous corks.

In one of the many richly-clad dells leading to

Broken Bay, I came across a sight which gladdened my eyes. It was what I may call a forest of Zamias. They grew in numbers, and in places occupied the entire ground, in company with maidenhair and other ferns. I had never seen these plants growing in a state of nature before, and I examined them carefully. Some of them were bearing fruit, and the oldest of them had turnip-shaped and scarred trunks (not much unlike pine-apples). These remarkable plants may be regarded as intermediate in their botanical relationship between the ferns and the pines. I regarded them with unusual interest, for they are the southern survivors of a once cosmopolitan group of plants. As far back as the beginning of the Secondary period in Europe such Zamias grew in England. They are among the most characteristic forms of the fossil flora of the Lias and the Oolitic formations; and in the celebrated "Dirt Bed" at Portland, in Dorsetshire, their scarred and dumpy stems (all petrified) are so common that the quarrymen call them "crows' nests." I have seen them many a time in the fossil state, just as they grew ages ago—now I was looking upon the lineal descendants of the same group in the uncleared part of an Australian forest!

In Australia—except where seaside resorting is merely a "survival" of the old British habit—the people go to the mountains. The seaside is too hot and relaxing, whereas the mountains are cool, and the ozonised atmosphere of the elevated gum-forests bracing and restorative. In this respect, the Australians of New South Wales follow the example of the Germans, who usually take their summer holidays in the hills and mountains; although, singularly enough, they prefer the hill places where there are some kind of "baths," or natural waters, which can be taken either inside or outside, at the will of the visitor.

The railway authorities have wisely lowered the prices of tourists' tickets from Sydney to the Blue Mountains. The next thing I would advise them to do would be to see the passengers were provided with a decent cup of tea and wholesome victuals at the refreshment-stations; for the trains leave Sydney at 7 o'clock in the morning, and as the railway station is conveniently situated as far away from the city as it can be dropped down, this means getting up at 5 o'clock or half-past, and rushing to the train on an empty stomach. By the time you reach a station where there is a "quarter of an hour for refreshments" (three hours later) it is not nice to be served by a half-drunken man, who looks as if he had slept in his clothes, and had been wakened up to serve you before his booze was over.

Anyhow, I never felt so famished—so utterly and entirely a-hungered—as I did on the frosty morning I went to the Blue Mountains. The day was the last of July, answering in England to the 31st of January.

The contrast between the extensive Emu Plains and the escarpment of the Blue Mountains brings out more strikingly the physical characters of each kind of scenery. The river Nepean runs almost at the base of the escarpment, a bold, strong stream, whose muddy waters tell us plainly of the large atmospherical denudation going on in the area it drains. Its banks are fringed with an abundance of bulrushes, in nowise distinct, that I could see, from our common English *Arundo phragmites*, besides some fine white "she-oaks."

CHAPTER XVII.

THE BLUE MOUNTAINS.

To visit Sydney and its enchanting suburbs without extending one's explorations to the Blue Mountains would be an unpardonable mistake. Numbers of people, both at home and in Australia, had impressed upon me the necessity of spending a few days there; but the chief, nay, with most folk, the only thing they talked about were the "Zig-zag railways." The Blue Mountains appeared to them to have been wisely designed for a zig-zag railway to be carved on their flanks.

Before I visited the Blue Mountains, I had grown very indifferent about the Zig-zag, but I durst not own it, and I had hypocritically to pretend I was deeply interested in all that my enthusiastic friends said concerning it. Now that I have seen it, I think less of it than ever!

What did concern me in my ardently-resolved tour in the Blue Mountains was the unique scenery therein; the geological origin of the materials out of which these imposing rock masses are constructed; the agencies which have scooped out such remarkable hollows as the Grose Valley; the animals—mammals, birds, reptiles, butterflies, &c.—peculiar to this region; the varied and remarkable flora, from the "mountain moss" which you see every tourist bringing home (a species of *Lycopodium*), to the rare mountain pines only found thereabouts, and the mighty forests of gum-trees which mask the entire region as the grass of a meadow in summer does the subsoils beneath. The Zig-zag Railway was only a means of carrying me thither and of bringing me back.

Nevertheless, I do not wish it to be thought derogatory on my part because I do not join in the frog-chorus of ignorant wonder which firmly believes this to be the greatest engineering feat in the world. On the contrary, I admired the pluck as well as the skill which carried it out, and took the railway straight across the Emu Plains to the almost precipitous escarpment of the mountains, and went at the latter like a battering-ram. There was something of the old Roman fashion of making hill roads in the notion, except that the Romans never condescended to zig-zag, but took their roads straight over. In point of engineering fact, the act of carrying the railway up the first face of the Blue Mountain plateau, and down again on the other, in this manner, was the simplest that could have been attempted, inasmuch as it included the fewest engineering difficulties. Not the less, on this account, was the genius of the engineer who projected the scheme.

The plains we travel over from Parramatta—indeed, the chief part of the country all the way from Sydney—is underlaid by a formation known among Australian geologists by the name of the "Wianamatta Shales." They are of more recent date than the Hawkesbury sandstones, and consequently overlie the latter. In some localities near Sydney, fossil fish (*Palæoniscus*) have been found in them. These shales are thin-bedded and very soft, so that they yield to weather-action very rapidly. In some places they are 700 feet in thickness. They may be seen in all the sections of the railway cuttings from Sydney to Parramatta, and some notable facts will be gleaned by observing them, for in many places they are much bent, fractured, and uptilted. About a score of such disturbances may be seen before we reach Parramatta junction.

I have already stated that the continuity of both the Hawkesbury sandstones, and the overlying and usually-accompanying Wianamatta shales, is interfered with on a magnificent scale at the Nepean River. The Wianamatta shales, which formerly overlaid the Hawkesbury sandstones of the Blue Mountains, have been all denuded off, or nearly so, for there is only a small patch now remaining, right on the top, after we have ascended by the first zig-zag, to show that they were once continuous with those of the plains, more than 2,000 feet below.

The Nepean River hugs the base of the zig-zag escarpment, very near where the Great Fault has produced the magnificent scenic contrast here displayed, and there can be little doubt it owes its existence to the disturbance. Probably its life as a river commenced with the first earth-movement, and has continued ever since, very likely through the greater part of the Secondary and the whole of the Tertiary periods until now.

The slow ascent by train up the zig-zag was very much like the sensation felt when going up in a balloon. I remember being first struck by this experience when I went up the celebrated Rigi Railway, near Lucerne. The lake and forests appeared to slowly sink, rather than to convey the idea that I was rising. Similarly on the zig-zag—Emu Plains, Penrith and Richmond towns, and the winding Nepean River, all seemed to be sinking to a lower level. Meantime, we are being hauled up, and then pushed up, the escarpment, so near to the wall of living rock that we can touch it with our hands—even gather the *lomarias*, *aspleniums*, and other ferns, which nestle in the wet nooks and crannies; whilst the structure and stratification of the rock-mass are plainly visible, and very much resemble that seen near Sydney. Here and there are patches of coarse conglomerate, almost suggestive of a glacial moraine, lying on the surface of the sandstone. Gum-trees of several species crowd the sides of the gullies we skirt and cross, and here and there a few stunted tree-ferns and grass-trees may be seen occupying the very bottoms. Through the gum-forest we catch glimpses of the sinking Emu Plains, and beyond, the landscape seaward is delineated in deepening cobalt tints.

Dr. George Bennett, the distinguished Australian naturalist, describes as follows a visit he paid to the Nepean River forty years ago. The natural flora has been little altered since:—"We observed a few noble trees of the River or White Casuarinus, or Australian Firs; they are of elegant growth, and the timber is valuable, when lightness, combined with strength, is required; but not durable in situations exposed to the weather. The tree attains a height of sixty or seventy feet, with a circumference of twelve to fourteen feet. Dense masses of reeds (*Arundo Phragmites*) grow on the banks, and are probably useful in protecting them from being washed down. This reed resembles its European congener, which in England is used for thatching and other purposes. The water was crowded with large semi-transparent leaves, which belong to our Australian species of *Vallisneria*—or, rather (for two smaller species are found in the vicinity of the Botany Swamps), the largest and finest of them; it is a very elegant plant. We then passed between beautifully-wooded and romantic ranges of hills. At one part, on landing we found *Ceratopetalum Arbutifolium*, and a slender bamboo-like plant, about four or five feet high, which, on examination, was ascertained to be a species of Stipa; the delicate narrow-sepalled clematis (*C. Stenopetala*) trailed over the shrubs, covering them with dense masses of white blossoms. The rocky lily of the colonists—a species of orchis (*Dendrobium speciosum*), with its masses of yellow, waxy wild grape (*Cissus Australis*) encircled the trees up to their highest branches. The life of Mr. Bidwell, the botanist, was saved (when he was lost in the bush, engaged in collecting plants) by the water he was able to procure from incising one of these vines. The Australian boys use the stems as ropes for swings; they are tough and strong, and serve the purpose very well. The varied-leaved hibiscus, or bastard curryong

(*Hibiscus heterophyllus*), was in full flower, bearing beautiful blossoms like the hollyhock; the wood is soft and spongy. Rope is made from the bark of this tree and others of the same tribe; and the blacks make their fishing-nets and lines from the cordage so obtained. Near one of them we discovered a nest of full-fledged birds of the Australian shrike, or butcher-bird—also called rain-bird by the colonists (*Vanga destructor*); they were regarded by our companions as a prize, and were taken accordingly to be caged and instructed in the art of whistling tunes, in which they are great adepts. The native tobacco (*Nicotiana longiflora*), with its long, delicate, white tubular flowers, was plentiful.

"As we proceeded, the river, although it continued very deep, diminished in breadth. Lofty towering hills rose above us; some bare and rocky, others covered with trees and shrubs. The scene was here and there diversified by a small clear space of cultivation on some fertile lodge, and by a few scattered huts of sawyers, who inhabit this quiet retreat for the purpose of cutting timber and bringing it down the stream for sale.

"This river rises in the Argyle district. After flowing some distance, it passes through the cow pastures, and is named the Cow Pasture River. At its junction with the Warragamba, it becomes the Nepean; and at Windsor, the Hawkesbury; and finally flows into the sea at Broken Bay, to the north of Sydney Heads. Its course is about 250 miles.

"I observed about the Rocky Hills a very large herbaceous plant, growing in great luxuriance upon the scarped ridges, and bearing flowers of reddish hue, in large drooping panicles; it was the elegant humea (*Humea elegans*). The whole plant on being bruised emits a delightful scent, so overpowering as sometimes to produce headache. I am of opinion that a very valuable perfume might be obtained from it. The pretty myrtaceous-tree (*Backhousia Australis*, or lancewood of the colonists), was growing very plentifully on the banks of the river; the leaves are of beautiful glossy green, and when pressed or rubbed between the fingers, emit a pleasant, aromatic fragrance. The Australian youths make bows of this wood, which is very tough and durable. Among the cliffs were numerous gannets, or mutton-birds; and we also saw several darters, or snake-birds; but they kept well out of the range of our guns. The Australian darters (*Plotus Novea Hollandiæ*) is a very shy bird; it often swims on the surface of the water, and at the slightest appearance of danger, sinks into the water, leaving only a small portion of the head and neck visible, and even this disappears on the movement of the sportsman. On this occasion they were sometimes seen motionless upon the trees on the borders of the river, either digesting a meal or watching for fish or reptiles; for they feed upon both. On the banks near another part of the river were patches of a very pretty stellaria, or starwort (resembling closely the English grass-leaved chickweed), studded with its delicate white flowers. Growing profusely on the river-side was the native mint (*Polygonum*, or knot-grass), which yields an agreeable scent when the leaves are rubbed between the fingers. There was also a beautiful and delicate silvery grass, evidently indigenous. The native raspberry was growing in some localities with great luxuriance, and had a very tempting appearance, with its bright, crimson-looking fruit, which on trial was found tasteless. The beautiful straw-coloured flowers of the *Callistemon salignum*, or willow-leaved tea-tree (*Callistemon lanceolatum*) diversified the scene; and we also observed some red cedar-trees (*Cedrela Australis*), now becoming very rare in the colony ; the largest was about 16 feet in height. From the foundation of the colony to within the last few years, this valuable wood has been commonly used for every purpose of house-building, as deals are used in England; but now it is becoming so scarce and expensive that deals have been largely imported. The wood is valuable from not being liable to the ravages of the white ants, and is also very durable. This tree attains a considerable size, being, in many instances, from 25 to 30 feet in circumference. There were clumps of the silvery or blue-leaved acacia (*Acacia subcœrulea*), with foliage of a delicate silvery hue : the wood is highly valued by the blacks for boomerangs, and from the bark a very good yellow dye has been produced.

"Some noble specimens of the white gum-tree (*Eucalyptus*) were growing gracefully, and from 70 to 80 feet in height, but of small circumference. Another species of acacia (*A. elata*) was also plentiful, of beautiful foliage and elegant growth, resembling very much a robinia. This tree yields a dye of a golden-yellow colour; but so large a quantity of the wood is required to form the dye, that it is found more economical to use the imported fustic. It is the *Mother coba* of the native blacks, and has a scented wood of fine, close grain. It has been found eighteen inches in diameter."

We practically reach the high lands above the first escarpment. It is a wonderful and, perhaps, unique fragment of the earth's landscape scenery, and its geological history throws a glamour of intense interest over the entire region. For nearly 150 miles by 100 we have these mighty rock masses, rising to as great a height as 3,200 feet at Mount Tomah, where the outburst and overflow of ancient lavas masked the soft shales, and so prevented them from being weathered and eaten away. At the same time, the hard basalt caused this locality to be lowered at a less rapid rate than any other portion of the Blue Mountains.

What ages have passed away since the materials of these Hawkesbury sandstones were originally gathered together! If they were blown together in one mighty continental sand-hill (as the Rev. J. Tenison-Woods alleges, and as the Loess beds, sometimes 1,500 feet thick, now covering North China, were formed, from blown sand), then the origin of the Blue Mountains is more wonderful still. But, even supposing the Hawkesbury sandstones were formed under terrestrial conditions, there must have been a subsequent depression. The sea came over their site, and covered them with the fine argillaceous sediment of the Wianamatta shales, as their enclosed fossil fishes indicate.

Then followed a slow and extensive upheaval, during which the soft shales must have been greatly denuded. Afterwards succeeded the era when the Great Nepean Fault commenced, and the country south began to sink, whilst, perhaps, that to the north was upheaved to form the region of the Blue Mountains.

At length, with the exception of comparatively small patches, the Wianamatta shales were completely peeled off the Blue Mountains. The action of rain, running waters, frosts, snows, wind, and sun—all of which had succeeded, in the hundreds of thousands of years allotted to them for the task, in almost utterly destroying and removing the overlying shales—now began to eat into the harder Hawkesbury sandstone rocks beneath. It was merely a question of time. The work is still going on, and the total results are visible in the grand and awe-inspiring views presented at the Weatherboard, in the Grose Valley, and elsewhere. There we behold immense valleys scooped out to more than 2,000 feet, walled in by mural precipices with 800 or 900 feet of sheer perpendicularity, over which streams of water fling themselves, to be lost in gauzy mist before reaching the bottom. Down below, where in many places even the bold feet of the undaunted surveyor have not yet trodden, the virgin forests extend for scores of square miles. From our giddy point of vantage, the arboreal vegetation below looks like velvet-pile. There is a solemn stillness resting upon those primitive, voiceless woods. No cry of bird or mammal ascends therefrom—Nature holds such places as her own uninvaded study! The rich yellow walls of sandstone precipices, on which the sun is shining, gleam with almost dazzling brightness, whilst the corresponding walls of the other side the valley are plunged in densest gloom. Out of and beyond the curving and widening valley we are gazing down upon with such awed delight, the vast forest-clad landscape stretches away and breaks up into dark cobalt blue hills, wherein is repeated the same unique scenic character.

Here and there some tributary, gorge, or valley is cut and carved out after the same fashion and by the same agencies as the main valley beneath us. At its junction with the latter, the mural precipice has the continuity of its walls broken by outstanding masses; like Cyclopean masonry; one square block is piled upon another, in diminishing sizes from below. The principal, of these are fast being christened, as "Pulpit" rocks, "the Orphans," &c., by visitors.

The fact is, the Hawkesbury sandstone is divided by traversing joint-planes into cubic masses. These become severally detached from the ever-wasting main mass. The rain and frost split them, separate them, and eat them away gradually. They fall down, fragment by fragment. A new set takes their places, and submits to the same fate; to be succeeded again and again in the eternal round of geological time. Thus it is those great valleys have been deepened and widened. The vegetation beneath is assisting the work of reducing once solid rock masses into sediment so fine that the waters of such streams as the Grose are constantly carrying them away, as if by invisible agency.

I was much struck with the broad resemblance which the mural precipices in all the valleys of the Blue Mountains had to the numerous "Heads" of Sydney Harbour. The latter are composed of the same kind of rock, and we have seen that it is really a part of a once continuous region, which was lowered by the Great Nepean Fault until the Sydney end was partly submerged by the sea. The same kind of valleys and gorges we behold in the Blue Mountains occupied by forests are at Sydney occupied by the sea—hence the origin of Sydney Harbour, and the family likeness between the famous "Heads" and the chief scenic features of the valleys in the Blue Mountains.

Since I returned to England I found that a "greater than I" had noticed the same resemblance. The late Charles Darwin visited the Blue Mountains during that eventful period of his young life when the "Journal of a Naturalist" was written on board the *Beagle*, and when the foundations of the great biological discovery of the law of natural selection were being slowly sketched out. Speaking of the weatherboard, he says:—"The country is elevated 2,800 feet above the sea level. Following down a little valley and its tiny rill of water, an immense gulf unexpectedly opens through the trees which border the pathway, at the depth, perhaps, of 1,500 feet. Walking on a few yards, one stands at the brink of a vast precipice, and below one sees a grand bay or gulf—for I know not what other name to give it—thickly covered with forest. The point of view is situate as if at the head of a bay, the line of cliff diverging on each side, and showing headland beyond headland, as on a low sea-coast. These cliffs are so absolutely vertical that in many places a person standing on the edge, and throwing down a stone, can see it strike the trees in the abyss below. About five miles distant, in the front, another line of cliff extends, which then appears completely to encircle the valley. Hence the name of bay is justified as applied to this grand amphitheatrical depression. If we imagine a winding harbour, with its deep waters, surrounded by bold, cliff-like shores, to be laid dry, and a forest to spring up on its sandy bottom, we should then have the appearance and structure here exhibited." The only difference is that Darwin evidently imagined the valleys of the Blue Mountains to be old "bays" and "harbours" (it was the geological fashion of that time to do so); whereas we now know that all "gulfs," "fiords," "arms of the sea," "harbours," &c., are only so many depressed ancient land valleys and surfaces up which the modern seas have found their way.

But these deep and hitherto unexplored valleys are doomed soon to lose their beauty, and I would strongly urge all who are fond of natural scenery to hie to the Blue Mountains ere it be too late. The rough hand of the commercial spoiler soon obliterates natural beauties. For at the base of the Hawkesbury sandstones there lie the coal and also the now rapidly utilised and almost equally valuable kerosene shale. Nature, in forming these unique and magnificent gorges and valleys, has cut through all the rocks right down to these valuable strata, and has laid them open to the light of day. Hence I need not say that commerce has already invaded these territories. You see curious wire railways, and heart-palpitating wire ropes and cages being lowered over the fearful cliffs in the search for and recovery of the aforesaid minerals. But it will not be long before this sort of baby-play is over, and tramways and railways will be traversing the valleys beneath, crowded with loaded trams of coal and shale.

I stayed at Mount Victoria, Blackheath, and Kotoomba. Delightful, never-to-be-forgotten places! The weather was highly favourable all the time I was there. It evidently wanted "a good press notice," and I am happy to give it one. A more delightful climate, or atmosphere better charged with ozone and odour of eucalyptus-trees, could not be found in all Australia. The neat wooden lodging-houses, dropped in the bush at Blackheath, Kotoomba, and elsewhere, looked so much like picnicking that I should have liked to picnic. Of course I visited Govett's Leap, Wentworth Falls, &c. One is obliged to do this in order (first of all) to be able to say so; because it is not nice for somebody who has visited them (and who is therefore always a superior person on that account) to inform you it is a great pity you didn't! All I can say of these places is they are quite as beautiful and impressive as many other places I saw.

But the scooping out of these Blue Mountain gorges and valleys is small compared with that great excavation at Lithgow, down which the second and most important Zig-zag descends. It has cut right through the shales and sandstones, through the coal and kerosene-bearing strata, through the Devonian (and perhaps also the Silurian) rocks, down to the bare granite. Something like a valley that!

I lingered on in the Blue Mountains till August, answering to our English February, when our first celandines would be timidly appearing, and a few diminutive Whitlow grasses would perhaps be out on sunny walls. But here, on either side, the road leading to Govett's Leap was a blaze of prickly acacias in blossom, several species of melaleuca, *Epacris grandiflora*, lovely yellow and scarlet dillwynias, a few blue campanulas, purple boronias, in places quite a garden. What must it not be two or three months later? All around are grass-trees, gum-trees, banksias, or "honeysuckles," isopogons, a few casuarinas, hakeas, &c.; and green parrots, green, yellow, and red ditto, yellow wrens, crow-shrikes, laughing jackasses, robins, &c., are ubiquitous bird companions.

Thus, my short tour in three of the colonies afforded me a pleasure and an intellectual profit I shall never forget. Even less likely to be forgotten is the generous hospitality, the fervent loyalty, and the manly spirit of our British brethren in this part of Greater Britain! When will our Statesmen learn that Australia is another part of England, as much so as Lancashire or Yorkshire, and that its public opinion should be taken into account as much as that of its relatives at home? At present, we consider that our English politics are parochial rather than imperial. A thoroughly united Greater Britain could dwell securely even amid the raging threats of all the opposing nations of the earth!

THE END.

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